

# THE HOUSES WE LIVE IN

JOURNEY CLUB  
TRAVELS



CARPENTER




Pupil's Name Quarles, John

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The Journey Club builds a house [Edith, Bob, Dick, Jack, Mary, and Helen]



CARPENTERS' JOURNEY CLUB TRAVELS

# THE HOUSES WE LIVE IN

BY

FRANK G. CARPENTER, LITT. D., F. R. G. S.

AND

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Pupil's Name \_\_\_\_\_

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## PREFACE

CARPENTERS' "Journey Club Travels" is a series of industrial readers on food, clothing, and shelter, designed for the use of pupils in the lower grades of the elementary schools. The children organize a Journey Club for the purpose of making trips to various parts of the world to find out about the foods they eat, the clothes they wear, and the houses they live in. They make their own investigations, and their personal observations are reported to the Club. These are supplemented by a Museum which they create with the samples of raw materials and finished products collected on their travels.

*The Houses We Live In* treats of the experiences of the Journey Club members as they learn about the materials used in building their homes. During their travels, the children keep before them the motto they have chosen, "to find out"; and they absorb

the principles of the production of their food, clothing, and shelter, and the manners and customs of their own land in the past, and of the people in other parts of the world of to-day. The primary features of transportation and commerce are clearly brought out, and all travels are made along geographical lines.

These books are based on the latest educational ideas of child interest and vitalized experiences. The plan is developed through a chain of industrial projects in which the personal element is emphasized, and every possible device is employed to stimulate the imagination. There are no cut and dried lessons. The subjects are presented as the adventures and actual experiences of the children themselves, and the Journey Club lives for the child-reader. Several of the Club members are mentioned by name and photographs of these same

children are used in illustrating each chapter. This series is the narrative of real trips made by real children.

Before starting out on their travels to find out about *The Houses We Live In*, the children talk of the homes of other times and other lands. They learn of the cave of the savage child, and they trace the evolution of house-building to the present day. In their first trip, they ride upon camels to see the tents of the desert; they photograph huts of mud, cane, and grass; and they visit the children of the Far Eastern countries. Then two of the Club members impersonate a boy and a girl of Colonial times, telling of the home life of our forefathers.

Airplanes carry the Journey Club over the great woodlands of the United States. The children spend several days with the lumber-jacks; there they watch a tree felled, cut up into logs, and sent through the mill. They climb down the side of a marble quarry in Vermont, and later chat with bricklayers and men who make concrete blocks.

By making actual trips throughout our country and over many parts of the world, they learn about iron and steel, glass, and paper, paints, oils, and varnish, and water supplies. Nor do they forget to find out about lighting and heating, furniture, rug weaving, and life in great hotels.

The adventures of the Journey Club end with the building of a playhouse by the children. The stages of construction are described one by one. The amount of labor and time involved in producing a house is emphasized so that the children may realize the part played in their lives by their fellows in other parts of the world, and the relation of all that they have seen to their own homes.

The idea of the Club formation and arrangement of the Museum should be carried out further in the schoolroom. If possible the playhouse should be built, or its building enacted in the form of a schoolroom play.

Some suggestions to teachers concerning class work and the contents of the museum will be found on pages 202, 203, 204.



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# THE HOUSES WE LIVE IN

## CHAPTER 1

### A JOURNEY CLUB MEETING

"THE Journey Club will please come to order!"

Jack, who is our president, is speaking. It is the first meeting of the year. Every Journey Club boy and girl is eager to hear the plans for our next travels.

As Mary is the secretary of the Club, Jack first asks her to give a report of the trips we have already made, for the benefit of our new Journey Club members. She reads from her record book:

"We first formed our Journey Club to find out about the foods we eat. We wanted to see where they come from and how they are made fit for our use. We took many trips through our own country and to far-away lands. We enjoyed these travels so much that when they were over, we decided to make further journeys to the homes of our clothes.

"No Journey Club member will ever forget our flights in swift airplanes, our days on express trains crossing our continent, nor our happy weeks on the huge steamships which carried us over the oceans to other parts of the globe. We have jounced through the desert on the backs of swaying camels and have ridden for hundreds of miles in automobiles. What sights we have seen! How many queer lands we have visited! Our Club motto is 'to find out,' and we have already found out about the foods we eat and the clothes we wear."

As Mary finishes her report, Jack asks Dick to tell the new members about the Journey Club Museum. He says:

"We have two sets of shelves which hold all the interesting things we have collected in our

travels. In one are the exhibits from our food trips. The second is filled with the curios which show where our clothes come from. We have gathered and mounted all these treasures ourselves."

"Now we will hear from Helen's committee," Jack says. "It has worked out a set of plans for our new travels." Helen rises and speaks:

"The Planning Committee thinks that the Journey Club should 'find out' about the houses we live in. We already know about our food and our clothing. But we have no idea where and how we get the wood and the stone and the many other things that make up our homes. My committee suggests that the next Journey Club trips shall be through the great forests, the mines and the mills, the foundries and the factories which help give us our houses."

We all talk at once, planning what we shall do. Then Bob cries out in a loud voice:

"When our journeys are over we can build a playhouse ourselves. My father's business is house building, and I know he

will help us to get the materials and show us how to put them together." We clap our hands. We decide to take first our trips over the world to see how our house materials are made ready for use, then to build a tiny playhouse, as Bob has suggested.

### Why We Need Houses

It is easy to see how important houses are to each one of us. Suppose our town should have a great earthquake like that in Japan some years ago! With the shaking of the ground, our houses would crumble to ruins. We should not know where to go and should roam sadly about over the piles of broken timbers and stones. As soon as we had found ways to get food and warm clothing, we should begin to seek shelter. We should need to protect ourselves from the cold and the wet and from other dangers.

The tiny insects and worms, the birds in the trees, and the beasts of the forests, all choose shelter of some kind for themselves and their families. We have seen the busy little ants digging away to prepare their many-roomed dwellings down



under the ground. We have watched the wee squirrels go and come from their holes in the trunks of our trees.

When we were in the North we saw the homes of the beavers, so carefully gnawed out of the walls of the stream banks.

Almost every living creature on this wide earth makes a home for itself.

### The Very First Houses

In the early, early days all men were savages. We believe they went naked or dressed in the skins of wild beasts and the leaves of bushes and trees. They probably lived upon roots and the raw flesh of animals and fish. We do not know what language they spoke, and we cannot tell exactly what kinds of shelter they had.

At other meetings of the Journey Club, we have been told of a savage boy called Strong-as-a-Lion, who lived in these early times. We know the story of how he may have got his first coat of fur skins. In the cold winter months, Strong-as-a-Lion prob-

ably lived with his family in a snug cave in the rocks. Here he was warm, and away from the storms, and safe from hungry wild beasts. Or perhaps on warm nights he would climb up into the trees whose thick leafy branches kept off the rain and hid



Even birds have houses

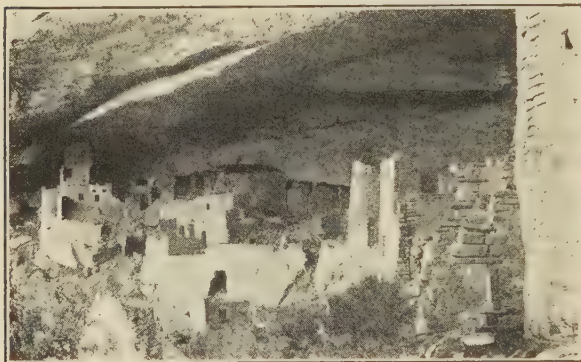
him away from the lions and bears.

Strong-as-a-Lion's great-grandchildren must have had better homes than his, for each year men have learned more and more about how to live comfortably. As time went on, they made tools of bone or hard stone and hewed their homes out of soft rocks and cliffs. They found they could sew the skins of wild beasts into waterproof tents. Sometimes they even made shelters of branches laid one on the other and chinked tight with mud. At last some one piled stones into rude walls and fitted a roof over the top. Thus was made one of the first houses such as we now have.

But it was hundreds of years after Strong-as-a-Lion slept in

his cave before men found out how to shape tools from the hard metals which lie in the earth. When at last they had these, they could chop down great trees and

whose homes are tents built of dry grass. We may visit lands where families dwell in the tree tops and in holes in the rocks, and in the Far North we might even find huts made of snow blocks.



Homes in a cliff

We remember that the homes of our friends of other more civilized lands are not all like ours. Taro in Japan has paper walls in his house. Hassan, our friend of the desert, dwells near a spring in a village where the homes are mud huts,

cut stone into blocks. Little by little, new ways were found for building their homes. The walls became smoother. The roofs became tighter. Some one learned to make bricks, then cement and plaster. From these simple beginnings developed the beautiful houses we have to-day.

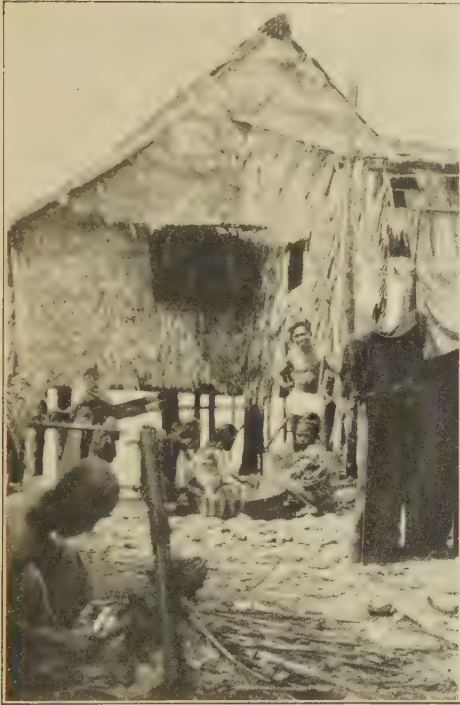
### Houses the World Over

In our Journey Club trips, we shall find that many people even now live in shelters as simple as those of Strong-as-a-Lion and his grandchildren. We may see savage men who go almost naked and

and Benito, the Philippine boy, has a house raised up on posts. Its walls are of cane covered with palm leaves, and its roof is of palm leaves sewed to a framework. In Europe the houses are more like our homes, although they seem odd because the styles are so different. Even in our own land we have many kinds of houses and buildings.

Let us suppose that Jack's house can talk. We ask it where we shall go to find out about the things that make up our homes. Listen! It says:

"You will have to go to the



A house made of dry grass

great forests to see the trees which give us houses our lumber. You will have to climb over the rocky sides of stone quarries. Then you will have to drop far down under the earth's surface to visit the mines which furnish our iron and coal, our lead, zinc, and brass, and the other metals we need. You will have to go to those ocean shores whose sands are melted to make our windows of glass. You will be

led hither and thither all over the world if you wish to find out about our fittings and furnishings.

"You see," the House says, "we are of many kinds. There are tiny bungalows and great hotels. There are cottages and palaces. There are vast stores and apartment houses and huge office buildings whose roofs peer into the sky. But it takes almost the same materials to make each of us. The only difference lies in the size and the cost, the style and the beauty."

We shall find as we travel that many, many people aid in giving us our homes. In this, as in everything else, the work is divided. Bob's father helps build our houses and Jack's father sells us the coal we need for heating our homes. We shall meet on



A tiny bungalow

our journeys lumbermen, stone-cutters, iron workers, and glass makers. We shall see other people who work in the factories that give us our wall paper, our carpets and furnishings, and still others who supply the electricity and gas for our lighting and heating. Every one must do his

share of the world's work and so help himself and his neighbors to live more comfortably.

The whole Journey Club is eager to start out on its travels. The new members are now taken in, and soon we are off to find out about the houses we live in.





## CHAPTER 2

### QUEER HOUSES OF OTHER LANDS

OUR first journey will take us all over the great round earth. We want to see some of the odd homes in other parts of the world.

We have so far to travel that we shall stop in each place only long enough to take photographs for our Museum.

Dick has a new camera. It was a present on his last birth-

day. He has learned to make beautiful pictures, and we have chosen him as our club photographer. We have packed extra films in our trunks, and are now ready to start.

#### With the Tent Dwellers

Have you ever seen a tent? Of course! Every one has. Jack



Jack's canvas tent

sleeps in a canvas tent when he goes on fishing trips with his father. Bob says the biggest one he ever saw was a huge circus

studded with jewels. Even today when we journey through Palestine we may sleep in white tents whose sides are covered



Army tents for soldiers

tent, and Helen tells us about the tents used by her Uncle Harry when he was a soldier in the World War.

Tents were among the very first shelters. They were probably made then of leaves and branches, or of animal skins sewed tightly together. But men have learned to make them better and better. Long ago the kings of the East had portable tents of gorgeous silks and wonderful cloths. These tents were embroidered and often

with gay dancing figures of every color of the rainbow.

Most tents, however, are for use rather than beauty. They are generally of the heaviest and coarsest of cloth.

Our Indian friends, Bald Eagle and Humming Bird, would tell us that their people once lived in tents made of deer skins. These were stretched taut over frameworks of wood and tied very tightly to pegs driven into the ground. The Indians

called their tent-homes wigwams or tepees. Indians did not stay long in any one place. They moved from one hunting ground to another. For that reason they liked a shelter which could be taken down and carried about on the backs of their ponies.

To-day our Indian friends have learned to build homes like those of the white men. It is only far north in Alaska that, during the warm summer months, we find our Eskimo cousins using tents of tanned walrus hide. Most of the tent dwellers of to-day live in the deserts of Africa and Asia.

We have now come all the way across the Atlantic Ocean to Egypt to look for the wandering tribes of Arabs who pitch their tents on the sand. Such people are called Bedouins. They move about from one place to another seeking scattered bits of desert grass on which to pasture their flocks.

Automobiles have brought us from the city of Cairo part way into the desert. The next stage

of our journey is on the backs of shaggy brown camels to the village where live the desert boy and girl, Hassan and Hada. These brown-skinned children join our caravan and ride with us farther



An Indian tepee

out into the great sea of sand. As our huge beasts amble along, they sway from one side to the other and backwards and forwards. They remind us of an ocean steamer in the midst of a storm. We do not wonder they are often called "the ships of the desert."

We strain our eyes gazing this way and that. We are trying



A ship of the desert



to spy the first tent. Everywhere we look we see only sand, sand, sand. Now Hassan cries:

"I see one over there at the right. Yes, there is a tent village." Sure enough! We can pick out dark specks on the sands. Hassan's eyes are used to the desert and he can see farther than we. We turn the noses of our camels towards the village and we soon reach the tiny stream near which the tents are pitched. We now make our beasts kneel down so that we may slide from their backs.

Dark-skinned Bedouin children gather about us and stare at us in wonder. At first they do not want Dick to take pictures of their tents. They have never seen a camera before, and they are afraid it may go off like a gun. At last they consent, and we later find that the snapshot is good.

What a funny place to live in! The tent is of coarse dark-colored cloth, woven in broad stripes. It

is stretched over a wooden frame and tied to pegs in the ground. It is so low that we must crawl in on all fours. A Bedouin boy tells us that they need no furniture and



A Bedouin tent village

that they sleep upon rugs spread on the soft sand. That curtain of cloth divides the tent into two rooms. Hada explains that one room is for the women and children, and the other for the men and big boys. Some Bedouin

tents have only one room in which the whole family must sleep.

As we travel on through the desert, we pass many such tent villages. Hassan says that the Bedouins, like gypsies, are always on the move. They travel in groups under a leader and are

plest of all houses. It may be of mud, straw, wood, or stone. We find that millions of the poor Africans live in these wretched hovels. In China, India, and South America we may see millions more whose homes are in huts. We shall not have time to take pictures of all the different kinds of huts, there are so many.

Dick makes one snapshot of a mud hut. The mud is plastered over a framework of cane and grass. The roof is of grasses plaited together. Such a roof is called a thatch. There are but two small rooms in this hut, and its windows are no more than holes in the walls. There is no floor at all. We wonder whether the roof will keep out the wet, but the native owner says that it almost never rains here. The roof is only a shelter from the hot rays of the sun.

There are many such huts as this in the little oasis where the picture was taken. They snuggle up to each other along the sides of the narrow alleys or



A hut of stone covered with grass

ready to fight any one who attacks them. Edith remembers that a band of wandering gypsies pitched their tents near her father's farm last autumn. The home of the real gypsies is in Roumania in Europe.

#### Huts of Many Kinds

While we are in Africa, Dick photographs huts of several kinds. The hut is the poorest and sim-



Siamese houses have walls of woven cane

streets, and great palm trees wave their leaves high above the low roofs.

Another of our pictures shows a hut of bamboo. Here the canes are woven together to form the walls, and the roof is thatched with dry grass. This hut is near the Equator where the weather is hot and the people need a cool house. We can see light through cracks in its woven walls. This hut is built loosely on purpose to let in the breezes.

In the larger oasis where Hassan and Hada live, the houses are bigger and their roofs are of hard clay. In great cities like Alexandria and Cairo, we shall find many of our African friends dwelling in homes as fine as our own.

Hassan points to the roofs as we ride through the oasis. The mud huts are so low that we look down upon them. Hassan says:

"You see the roofs are quite flat. The people sit upon them



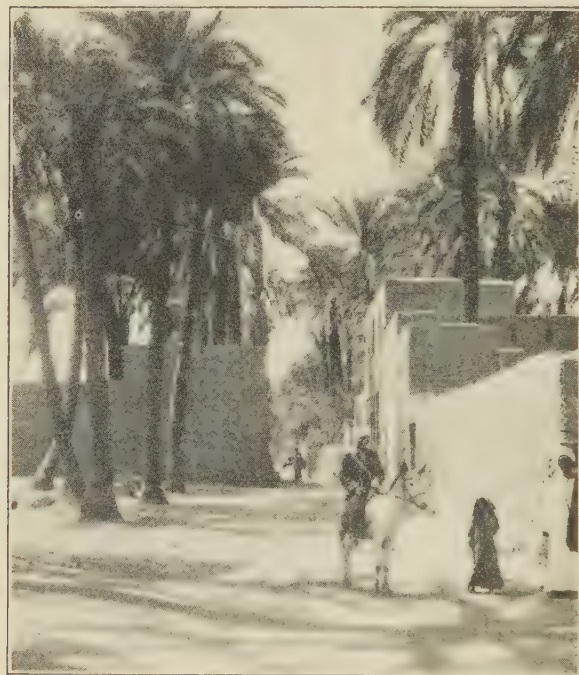
in the cool of the evening when the sun has gone down. Often they bring their rugs and sleep there at night under the stars."

of huts for our Museum. We find stone huts and wooden huts in the mountainous regions. In South Africa we see queer mud huts shaped like a mound.

These are built of a clay which is made by white ants. The busy insects mix the earth with a juice from their mouths, turning it into a kind of cement. Men sometimes gather this same clay and build their homes from it.

There are pictures of grass huts in our collection. Some are woven as well as the finest of baskets. Others are built of elephant grass whose stalks are thicker than a lead pencil.

One of the best pictures in our Museum shows a hut made of snow. It is



*Publicities' Photo Service*

In an oasis village roofs are flat

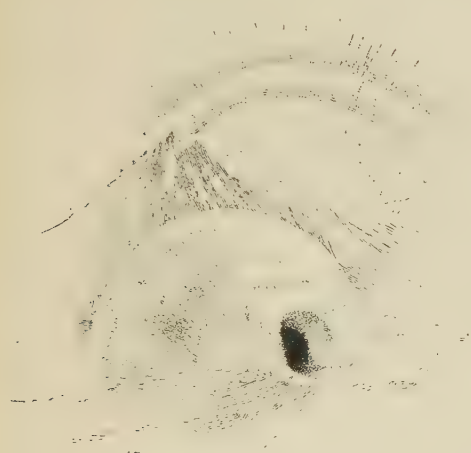
Jack asks why there are no chimneys and Hada replies :

"The cooking is done out of doors in little clay stoves. There is no furniture. In most of these huts a ledge built along one side of the room serves as both beds and chairs for the whole family."

We take many other pictures

the home of our friend, Ikwa, the Eskimo boy. This snapshot was taken on a former trip to the Northland. Ikwa calls his snow home an igloo. We remember he showed us that the blocks of snow are laid down in circles which grow smaller and smaller. The igloo is as round as the

beautiful dome of the Capitol at Washington. That low opening in front is the entrance. We had



Igloos are huts of snow

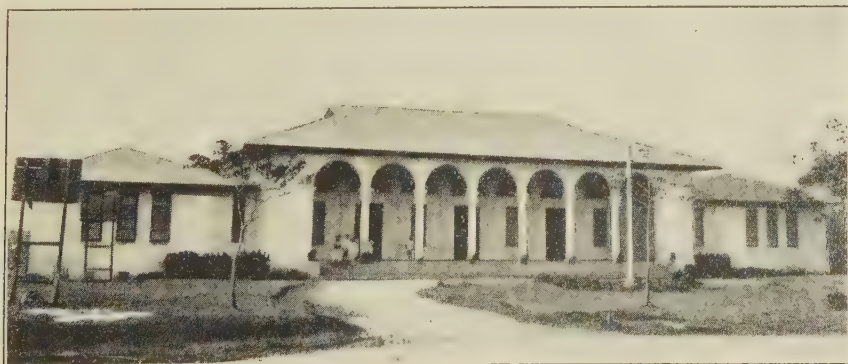
to crawl through it on our hands and knees to get inside the hut. Ikwa keeps snug and warm in his snow home. He thinks his snow bed, with its coverings of moss,

grass, and fur skins, is the best in the world.

#### Houses Made of Bamboo and Nipa Palm

The Journey Club makes a big jump round the globe before its next stop. For many days we sail through tropical seas. Then we land on the shores of our own Philippine Islands. We see the Stars and Stripes flying over the school buildings in the towns, for these islands are part of the United States.

How different it all is from the rest of our country! The houses in the large cities are somewhat like our own. But they are mostly made of wood with galvanized iron roofs. The larger buildings are built of stone and



School house in the Philippines

concrete. They gleam through the palm trees in the bright sunlight. Benito, a Filipino boy of our own age, takes us into the country to see how the poor people live. As we walk along over the roads, he tells us tales of these islands and of our brown cousins upon them. He says:

"A few of our people used to live up in the tree tops. Their homes were thatched huts built high in the branches, well out of the reach of wild beasts or en-

emy tribes. The tree dwellers climbed to their shelters by means of rude ladders which they drew up after them. They were afraid of the other tribes, some of whom used to be cannibals, who eat human beings. So they kept a sharp watch, and shot poisoned arrows at any one who came too near. You may still find people living in the tree tops in some parts of the world."

Benito shows us that the Philippine houses are often built up on



House in native village



posts. He says they are lifted high off the ground so that they will keep dry when the rains and floods come and will not fall down during an earthquake. We climb up a rude stairway which leads to one of these homes. We ask the woman in the doorway if we may look in. She is very polite and bids us enter. The floor is built with wide cracks so that when she sweeps, the dirt will fall through.

Edith thinks cleaning this house would be easy.

As we stroll back to town, Benito points out a palm tree whose leaves are so huge that one of them would be taller than Jack and Bob put together.

"That is the nipa palm," says Benito. "Its leaves make the roofs for most of our houses. We lap one over the other and sew them to a wooden framework which rests on the walls. These roofs will shed water. They keep

the houses quite dry inside." We see also clumps of the feathery bamboo. Its straight cane stalks are used for framework and indeed often for making the walls of a house.



Clump of feathery bamboo

### Some Pictures from the Far East

Dick takes many pictures of the homes of our other Far Eastern friends. One shows the house of Ah Chee, the Chinese boy whom we have met before in other Journey Club trav-

els. His father is well-to-do. So Ah Chee does not have to live in a wretched mud hut like the poor Chinese workmen and farmers.

Ah Chee's house is of hard brick. Its roof is of tile, extending far beyond the walls, and curling gracefully upwards at each of its four corners. The house has several rooms. The furniture is much like our own, with tables and chairs and even beds like ours.

Ah Chee also takes us to visit his rich uncle who lives in great



Ah Chee's roof curves up at its corners

style. His home is surrounded by a high wall. Inside this wall are a number of separate houses. Ah Chee's uncle has one house for himself and his family, one for his servants, and another for guests. The windows are mostly of paper, although Ah Chee points proudly to some of real glass. Glass is rare here in the Far East. In its place the Chinese use a strong thin paper which lets the light through.

One of the strangest ways of living is that of the families upon the Chinese river boats. Mary has seen people in our own country whose homes are the flat-boats which go up and down our canals. In Siam too, where floods come every year, the houses float on the water. They are tied to posts driven far into the ground. This keeps them in their places.

We next visit the home of

Taro, the Japanese boy, who has taken us on so many interesting trips through his country. His house is of wood beautifully fitted together. The roof is black tile. Its walls are made so that they slide back and forth. The outer walls may even be taken away and sometimes the whole house is left quite open. The inner walls are of paper pasted on frames of wood. They can be slid out of the way and two rooms can be turned into one in the wink of an eye. We see that the light comes in the windows through the same kind of paper we saw used in China.

At Taro's home our heavy shoes must be left at the door. They would soon tear the fine matting which here covers the floors. While in the house, we shuffle about in the slippers which Taro gives us as we enter. Mary asks Taro why there is no furniture. He replies:

"We do not need it. We sleep on this soft matting and cover ourselves with warm quilts. We have little wood pillows which fit

under our necks. We sit on the floor on straw cushions, and we each have our own little dining table about two feet square and as high as our laps. Oh, we are very comfortable, I assure you."

Taro's house has several rooms. We find that the Japanese have



Taro's house has paper walls

homes of all sizes, from those of one room to great two story palaces. Almost every house has a garden of some kind or other. Taro explains that his people love beautiful things. They delight in turning a bit of bare ground into a bower of flowers and plants.

The houses in Korea are more like African huts. They are of mud and stone and their roofs are of straw. They are built



in the shape of a horseshoe with the rooms for the women in the

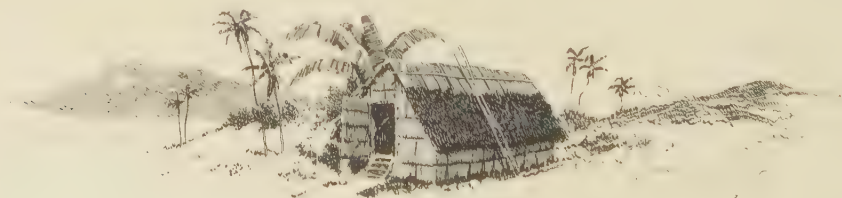


Pagodas

curve at the back. The richer Koreans have more modern houses like those of Ah Chee and Taro.

Dick has pictures of some palaces and temples of the Far East. Some are six or eight stories in height. They look like towers. They are called pagodas. Each story has its own roof sticking out above its windows. The most beautiful of all eastern temples is in India. It is the Taj Mahal in the city of Agra, and many think it is the finest building in the world. India has other wonderful temples and palaces, but the most of its people are poor and live in dark, dirty hovels.

As we make our hasty trip round the world, we see that each land has different kinds of houses to shelter its people. Each has its own customs, its own manner of living, and its own raw materials with which to build. It must use what it has in the best way it can to meet its own needs.



## CHAPTER 3

### PATIENCE TRUE AND JOHN ADAMS VISIT THE JOURNEY CLUB

"No more from that cottage again will I roam,  
Be it ever so humble, there's no place like home."

"WHAT are we waiting for?" Edith asks as she looks about at the members of the Journey Club. We are gathered in the living-room of Bob's home for our meeting to-day.

"We are to have visitors," says Jack, "visitors who lived hundreds of years ago."

As he speaks, a girl appears in the doorway. We cry out in surprise. She is clad in white kerchief and cap, and a dress of dark homespun that falls to her ankles.

"Why, it's Mary," Dick cries. The girl makes a deep curtsy.

"I am not Mary to-day," she says. "I am Patience True who lived long, long ago, and I have come to tell you about the first American houses and how they were built."

We are delighted. We shout our welcome and beg her to be-



Mary dressed as Patience True

gin. This is the story Patience True tells us.

### A Log Cabin Home

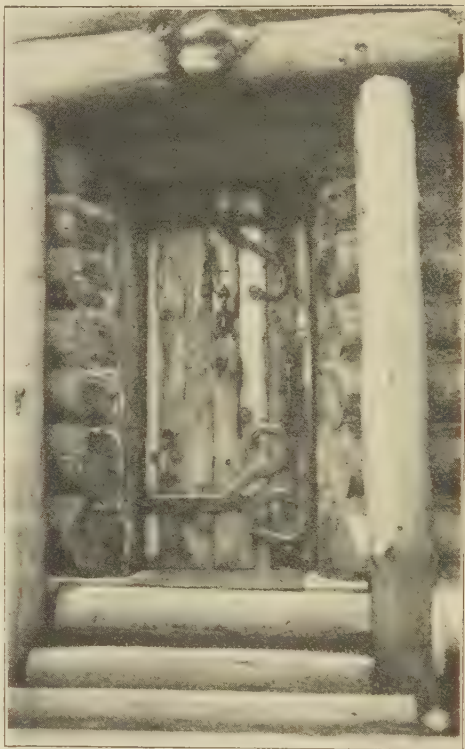
"My family were Pilgrims. We came to the new world of America on the good ship *Mayflower*. When we landed on Plymouth Rock, we found ourselves in a wilderness of trees. We had very little food left on the ship and the men could get little on land. Before the winter was over we were nearly starved. There was no shelter anywhere on the shore, so the women and children stayed on the *Mayflower* while the men built rude houses for us to live in.

"My father knew he should have to build our own home himself, so he had brought with him sharp axes to cut down the trees. There was plenty of stone in this wild land, but it was hard to tear it away from the grasp of



Our main tool was the ax

old Mother Earth. Our chief house material was wood and our main tool was our ax. With it Father chopped down the trees



Log cabin doorway

and trimmed off the branches. He cut the logs the right length, and the others helped him to drag and roll them to the place where our house was to be.

"Neighbors came to help Father put up his cabin. He had dug a deep ditch in the form of a hollow square. I watched the men stand the logs on end in this ditch. The logs looked like a row of stiff wooden soldiers.

They were fastened together with long pointed pegs. You see, we had no nails in those days. | was built up to the height wanted. The rafters and roof were then

“Spaces were left in the walls for the door and the windows. Our roof was hewn boards, chopped out from the logs. Father placed other smaller logs on the roof-boards to weight them down well. Some of our neighbors roofed their cabins with thatches of branches.

There were no lumber mills then with fast whirring saws to turn out smooth boards or nicely shaped shingles.

“Another kind of log cabin which we Pilgrims built was made in quite a different way. The logs were notched at each end. First, two were laid down side by side and as far apart as the width of the house. Then two more were laid across their ends. The notches were fitted into each other

and the logs were thus locked together. In this way the cabin



Cabin with logs notched at both ends

put on. The Indians used to make fun of such cabins. They said :

“ ‘White man, all same pig, lives in a pen.’



Chimney on outside of cabin

“I helped my father chink the cracks and make the house warm. I brought tiny stones and put them in between the big logs. We then plastered all the holes with mortar. Bigger rocks were used to build the chimney for our great fireplace. The chimney ran up the outside of the house. It covered

almost one whole end of it. Our home had but one room with a



loft up above under the high slanting roof.

"You would have laughed at our windows. We had no glass, so we used a strong paper dipped in oil. This let the light through, but we could not see out. Our doors and our shutters swung on hinges of leather. The lock on our door was a wooden bar or latch which was dropped and lifted by means of a string. This was called the latchstring. It often hung out through a tiny hole in the door so that the latch could be raised from

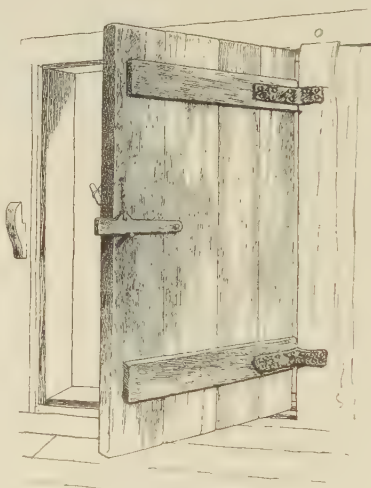
outside the house. At night before going to bed we pulled the latchstring inside. When we wanted to tell our friends they were always welcome, we said, 'The latchstring is out for you.'"

#### How Patience True Lived

"How would you like to live in a house of one room with an earth floor and with no heat but the warmth from the fireplace?"

Patience True asks us. "To go to bed, you would curl up in a wooden bunk nailed to one side of a wall or crawl up a ladder and lie down on a heap of pine boughs on the floor of the loft.

"All of the cooking in our log cabin was done over a wood fire in the fireplace. A swinging bar of iron called a crane held the pots and the kettles over the flames. Our fire was precious, I can tell you. We had no matches, and so we tried to keep our fire always burning. Of course we could get more



A latch and leather hinges

fire by striking a spark with our pieces of flint and steel. The Boy Scouts know how to make fire without matches. By rubbing two sticks together, they can make a spark fly into dry shavings and leaves and then can blow it into a blaze. We sometimes found it easier to borrow live coals from the fires of our neighbors.

"You would never guess what kind of dishes we had. They

were pieces of wood, — nice, smooth, white poplar. Father made them himself, as he did all of our furniture. He scooped bowls out of the centers of square wooden blocks. In especially big bowls the family porridge and stew were served. Our spoons were of pewter and wood

and we often ate with our fingers. In those days forks had never been heard of.

"The rest of our furniture was hewn out of logs. Boards laid on two supports formed our dining table. We sat upon rude stumps or benches made of split

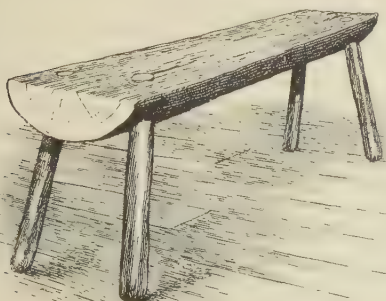


Boy Scouts making fire without matches

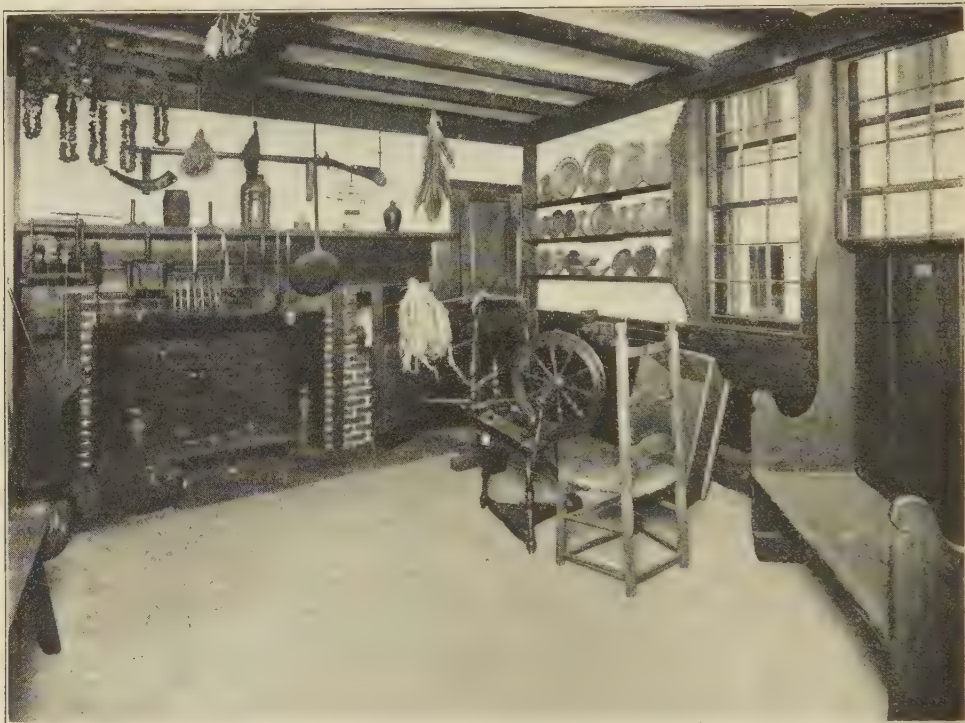
logs which had sticks fastened on the four corners to serve as legs.

"Pine knots burning in the fireplace gave us our light. Now and then we had candles, but they cost a great deal. Later on we used iron lamps in which we burned wicks soaked in fish oil. We carried all our water in pails from the woodland springs. I shiver to think of the cold winter mornings when I had to break the ice in the buckets to get water to wash my hands and face.

"We always barred our windows at night for fear of the



Bench made of a split log



A fine Colonial fireplace

wild Indians. Each group of houses had a log fort with a log fence around it where the people could go if the Indians came. These places were called stockades. Their walls were so high that the savages could not climb over them.

"You may think it was hard to live in this way. Perhaps it was. There were no telephones, no telegraphs, and no daily newspapers. The moving picture and

the radio had not been dreamed of. Even books were scarce. Our schools were bare log cabins, and each boy and girl had to do much work at home. But still we were happy. Do you know the verse which says:

"Oh, the old house, the old house,  
What though the rooms were wee?  
Oh, kind hearts were dwelling there,  
And children full of glee."

"Some great men have come from just such log cabins.



Abraham Lincoln studied in the light of an open fire in a log cabin. Another log cabin president was Garfield, who was born in a tiny log house in northern Ohio."



A stockade

### In George Washington's Time

When Patience True's story of homes in the early Colonial

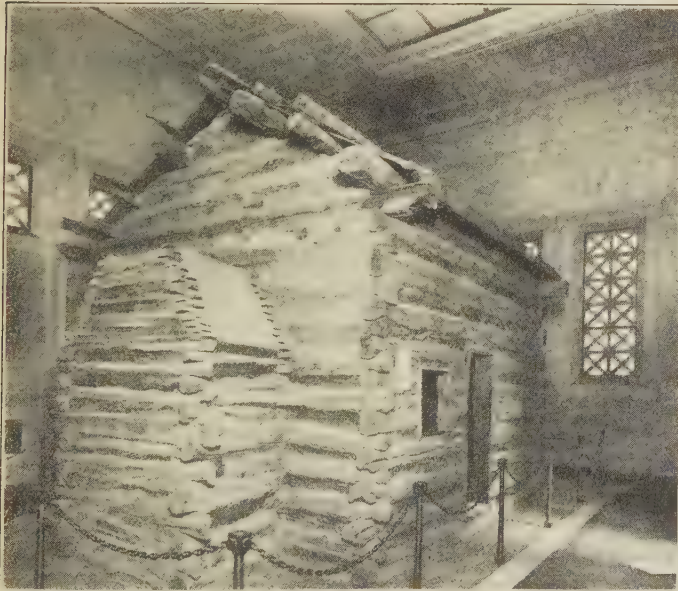
days is told, we are surprised to see another strange figure appear

in the doorway. It is a boy as oddly dressed as Patience True.

He has a white wig with a little pigtail tied with a bow of narrow black ribbon. He wears a long coat of cloth and satin knee breeches. He has ruffles of lace at his neck and his wrists. He looks very fine.

"Oh, it's Bob," Helen shouts, and the figure in the doorway bows very low.

"I am not Bob



© Canfield and Shoos

Log cabin in which Lincoln was born



now," he says, "but John Adams of George Washington's time. I have come to tell you of the homes the boys and girls had then."

He tells us how the early settlers learned each year to improve their log houses, how every ship that came from England brought more things for their comfort, and how soon they began to manufacture for themselves. Our United States then belonged chiefly to England. The settlements were called colonies and were ruled by the king of England over the sea. Later the colonists broke away from England and started to build a nation of their own.

"When George Washington was President," John Adams says, "there were comfortable homes through all the colonies. But they were not of the same kind in the different places. The first Americans came from many countries, from England and from

Scotland, from France and from Holland. So they liked different sorts of houses. Also in each section of the new world they had different materials with which to build.

"In New York where the Dutch lived, the houses looked like the homes in Amsterdam. They were often of brick of several colors, laid in a pattern. Their high roofs were shaped like those of real Holland houses. Every home had its tiny porch at the front door. This was called a *stoep*. The family sat there on wood benches each fine summer evening."

John Adams describes the cottage homes of

New England, with their long sloping roofs and their beautiful doorways. We like best of all his tales of the colonial homes of Virginia, Maryland, and other parts of the South. The Southern States had fewer towns than those farther north. People rode miles upon horseback from one house to another, and we hear of gay



How boys looked in colonial days



A Dutch house in old New York



Mt. Vernon, the home of our first president

parties and much visiting back and forth. The Southern houses were large. They often had many small buildings to shelter the negro slaves.



Arlington, the home of Robert E. Lee

Some of the best of these old Southern mansions are still standing to-day. We decide to take a trip to Mt. Vernon, the home of George Washington, as soon as we can. It is built on the wooded

slopes overlooking the Potomac River, not far from the city of Washington. On this same winding stream is Arlington, the beautiful estate of the Southern general, Robert E. Lee. Arlington is now the cemetery in which we bury our dead soldier heroes.

John Adams closes his talk with stories of the fine furniture that was made in those days. He tells us of tables and chairs of shining mahogany, of four-posted beds with thick draperies above them, and of tall grandfather clocks with crude wooden works. He says that early American furniture is much prized to-day. Some people prefer it to the newer pieces from our modern factories.



The Philipse Manor House at Tarrytown

## CHAPTER 4

### DAYS IN A LUMBER CAMP

“What do we plant when we plant the tree?  
We plant the houses for you and me.  
We plant the rafters, the shingles, the floors;  
We plant the studding, the lath, the doors,  
The beams, and siding, all parts that be;  
We plant the house when we plant the tree.” —*Abbey*

PUT on your heaviest sweaters and button your coats well up round your necks! Do not forget your warm woolen gloves and pull your caps down to cover your ears! We are going north to a land of biting winds to visit a lumber camp in the heart of the deep forest. It is March and we must start right away, for winter is the logging season in most of our woodlands.

Our journey to-day is to find out about the wood that helps give us our houses. Jack lives in a white house built entirely of wood, and Bob's house of stone has many wood parts. Most of

our rafters and flooring, our doors, beams, and window frames were once tall trees reaching their branches up toward the skies.

Steel and concrete are taking the place of wood in many of our great hotels, stores, and schools; but even for such buildings some lumber is needed.

As the Journey Club gathers, we talk of the things we get from the forests. Mary speaks of our furniture, and Edith tells of the wooden wagons and tools on her father's farm. Dick reminds us that some ships are still built of wood. Bob says that many logs from our forests are burned to



heat our homes and to give us the power to run many of our machines. Helen thinks we should not forget that the trees protect us from the sun and the wind. She likes them best growing,

### The World's Woodlands

"Where are we going to-day?" Mary asks Jack, our Journey Club president.

"We are going to visit a big lumber camp right here at home



Jack lives in a house built of wood [Mary, Bob, Dick, Helen, Edith, and Jack]

along our streets and our roadways, in our yards, parks, and forests.

Then Jack begins to count on his fingers other things we "plant when we plant the tree." He begins, "Books, newspapers, pencils, rulers, tops, and baseball bats, and —" He would go on and on if he only had time.

in the United States," is his reply. "We could see forests in many other parts of the world. In almost every damp land, trees will grow well. They need a great deal of rain. In Africa and South America there are vast woodlands, and the damper parts of Australia also have many forests. Mahogany and rosewood

come from those forests. But we do not bring much lumber from these countries for our houses. Their wood is too heavy to carry over the country, and a great deal of it will not float on the streams. For these reasons it is hard to handle.

"We might go to Europe," Jack continues telling what he has found out for us. "We could see there the great forests of Russia and the other north countries. But one third of all the trees in the world grow here in North America. Canada has vast forests. Yet the lumber she cuts is only one tenth as much as that of the United States. Our woods are light and easy to move. We have broad rivers to float them from one place to another. Our many railroads also help carry the logs to the saw-mills and the finished lumber to the house builders. So we shall make our journey over our own land."

When Patience True landed

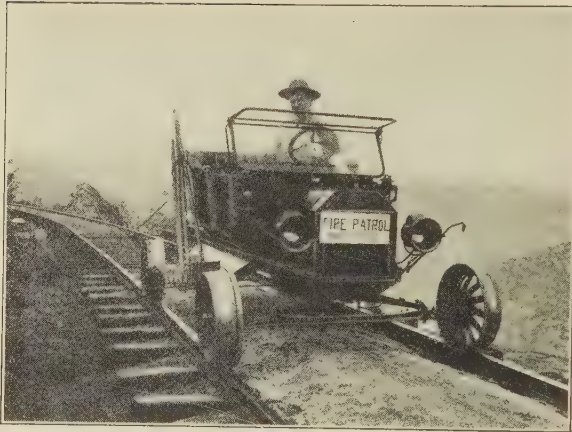
with her Pilgrim family from the good ship *Mayflower*, one half of all our United States was wood-



A North American woodland

land. As she stepped out on the shores of Massachusetts, she saw nothing but forests where —

"The woods against a stormy sky  
Their giant branches tossed."



Fire patrol

To-day more than half of those forests have been cut down. Less than one fourth of our country now has trees growing upon it. Much timber has been used to build us our houses, much has been burned to keep us warm, and much has been made into the thousands of wooden things we need every day. Some has been burned by the forest fires, which eat up acres of trees as they rage over the land. We have also wasted a great deal by careless cutting.

We do not want to lose all our trees; so our Government has formed a department called the National

Bureau of Forestry. This is filled with men who care for our forests and plant new trees every year. Dick once made a trip through one of the National Forests in the West. Our Government owns more than one hundred and fifty of these woodland parks. In them no trees may be cut without its consent.



© Davey Tree Surgeons

Trees can be patched with cement

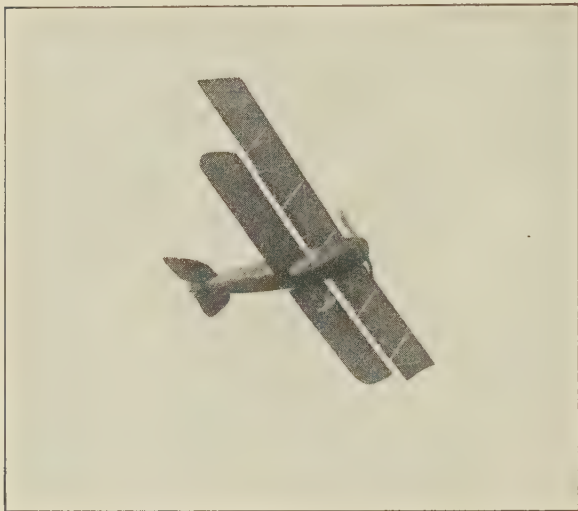




In one of our National Forest Parks

© Seattle Chamber of Commerce

Helen speaks of the tree doctors who can patch up a sick tree and make it healthy and strong enough to live many years. She



Like birds we shall fly here and there

says they often fill the holes in the tree trunks with cement and cover them with tin.

#### A Bird's Eye View of Our Forests

We have now reached the flying field where airplanes await us. The first part of our journey is to be through the clouds. Like great birds, we shall fly here and there over our land; and through our strong field glasses, we shall peer down at the forests as we pass above them.

Our planes are first turned toward the South. We soar for days over our Southern Forest. All the way from southern New Jersey to the Gulf of Mexico we fly above country covered with trees. Now and then we drop down near enough to see that the most of them are pine trees and other evergreens. An evergreen is a tree which keeps green all the year round.

As we turn our faces north again, we glide over dark patches. These are the trees of the great Central Forest which once ran

from the Atlantic Ocean to the plains of the West. They are walnut, oak, elm, chestnut, and hickory, and other hard woods. Most of these trees lose their leaves when the autumn days come. They are called deciduous trees.

On and on we fly to the north. Now we are skimming the tree tops of Maine. Here is the beginning of the vast Northern Forest which covers our lumber states of Maine, Michigan,

Wisconsin, and Minnesota. Here and there we see the blue waters of the Great Lakes, and catch glimpses of forests across the Canadian border.

As we sail through the air above the plains and the prairies west of the Mississippi River, we peer out in vain over the wings of our air birds. There are no vast forests here. The land is too dry. But at last we reach the Pacific Coast Forest and follow its tree-covered lands through California, Oregon, and Washington. We

have to keep our planes several hundred feet from the ground so as not to hit the tops of these forest giants. The Pacific Coast Forest is smaller in area than some of the others, but the trees are much larger than those farther east. They give us much fine lumber.

#### A Visit to a Lumber Camp

Our planes glide to the ground in a clearing on the edge of the forest. We are in the midst of some of the tallest trees of the



In a lumber camp





Ready to fly far away [Some members of the Journey Club]



world. We must crane our necks to look up at their crowns waving in the breeze so far above us. The delicious fragrance of the pines fills the crisp air. Although it is still winter, there is here no snow on the ground.

The streams are not frozen, as they are farther east in the lumber camps of our Northern Forest.

It is late afternoon. The lumbermen are coming in from their work. They make us welcome and say they have plenty of room for us in their camp for a few days. We

walk with them to a group of log buildings. These are as rough as that first home in which Patience True lived. They are shacks of great logs chinked tightly with mud. We peep into one. It is the blacksmith shop where the tools are repaired and the horses are shod. Near by is a log stable which shelters the camp animals. Those two long buildings over there are the homes of the lumber-jacks, as the wood cutters are called.

Clang! Clang! Clang! The ringing of a bell breaks the for-

est stillness. "Come to supper," cries a tall man. He is the "boss" of the camp and has charge of all the men and their work. We file into the log dining hall. This is known as the



Dinner time at the log mess hall

mess house. What a lot of men we find here! There must be more than one hundred sitting at the board tables. We take our places and look about us. Our seats are rough benches of boards and logs. The cups and plates are all tin, and our knives and forks are of steel. There is no cloth on the table, and we must wipe our fingers and mouths on our pocket handkerchiefs.

The food is coarse but well cooked, and the crisp air has given us good appetites. We enjoy our supper of soup, baked

beans, and potatoes. We do not care for the strong black tea which the men are drinking, but we think we have never tasted better pies, cakes, and biscuits. Now and then the fat man cook, clad in a huge oilcloth apron, brings in more food, or he sends dishes round by his boy-helpers whom the men call "cookees."



Burmese elephant loading logs

Supper is soon over. The men are so hungry that they eat quickly and with almost no talking. Afterwards we go with them to the bunk house. This is a huge room made of logs with a stove in the center. It has wide shelves built round its walls. These are divided into spaces just the length of a man. The spaces are the bunks which serve as beds for the lumber-jacks.

Two bunks are placed one over the other in the same way as the berths in a Pullman sleeping car. Boughs and furs and heavy, coarse blankets are spread in them to take the place of our mattresses.

We gather round the stove and listen to the songs and stories of the wood cutters. They tell us

strange tales of lumbering here and in other lands. One story we like much is about the elephants in Burma which haul heavy logs out of the forests. They carry the logs with their trunks, or drag them along over the ground by means of iron chains tied to their hind legs. These elephant lumber-workers

have been taught to make neat piles of their logs. They will push and pull with their trunks until they get the logs just right.

Jack asks the "boss" what trees we use to build houses. He says:

"Most of our building lumber comes from the kind of trees we have growing here in this forest. The best are spruce, fir, hemlock, and pine. The United States

also uses much maple, walnut, and oak, hickory, cherry, and birch. Here in the West we are especially proud of our giant red woods and our fine Douglas fir trees."

We climb into our bunks very early, for we must rise at dawn to go out with the lumber-jacks. The men do not undress. They just kick off their shoes before they lie down on their beds of pine boughs. They pull their gray blankets up to their ears. We are glad to follow their example, for it is chilly in the bunk house and we fear the fire may go out during the night.

### The Fall of a Giant

With the first rays of the sun we are out of bed. The ice-cold water in which we wash our faces helps wake us up. We hurry to the mess hall and have breakfast with our new friends.

What a hustle and scurry! The men are now gathering up their axes and saws and getting out the little engines on wheels, which they call "donkey engines." A tall wood chopper asks us to go along with him to see how he works. He is a blond Swede

named Chris. He is said to be one of the best lumbermen of the whole camp. We trudge with him over the rough roadways which have been cut through the forests to get the logs out. The other lumber-jacks follow.

"That tree is ours. We cut him down," says Chris, pointing to a great giant almost three hundred feet high. We join hands and try to make a ring round its trunk. It takes seven of us with outstretched arms to reach all the way.

Chris calls for Olaf, another wood chopper, to help him bring down this forest giant. First they make gashes in each side of the tree trunk several feet from the ground. They tell us the wood near the roots does not make such good lumber. Now they fasten long boards into the gashes and climb up on them. They stand on these spring boards as they chop down Mr. Tree. Chris shows us that his shoes have iron spikes in their soles to keep him from slipping.

Now the men begin to swing their double-edged axes. Chop! Chop! Chop! Chop! First one ax, then the other cuts through



the thick bark. Huge chips fly out this way and that, covering the ground. Chris and Olaf work away until they have made a

very center of the roadway. Then he says:

"You watch tree. He fall on that stake."



Chris and Olaf cut a notch in the trunk

notch so big that Bob and Jack could sit up straight in it. Chris boasts that they have cut the notch in such a way that the tree

At last the notch is big enough. So Chris and Olaf begin to saw the opposite side of the trunk. Their tool is a crosscut saw of



A crosscut saw

will fall just where they wish. He climbs down from the spring board and drives a stake into the

finest steel. It has a handle at each end. Back and forth! Back and forth! Its sharp teeth





A fallen giant of the forest

bite their way through the wood. Now and then Chris and Olaf stop their sawing to clean off the saw with kerosene. It takes them several hours to saw through such a thick trunk. Suddenly we hear Olaf cry:

"Now everybody be careful. He is coming down."

We see the leaves at the tip-top quiver and shake. The whole tree seems to shudder. There is a light cracking noise which grows louder and louder. We hold our breaths as the giant topples over. Faster it falls. A hollow roar echoes through the forest as the tree strikes the ground, and the earth seems to quake. We run to look for the stake which Chris

had put in the roadway. Sure enough! The trunk has fallen upon it and driven it out of sight into the ground.

"Come here," Jack calls. He is standing beside the sawed end of the trunk. It is nearly twice as tall as he. "See all those rings in the wood! They tell how old the tree is."

Chris explains that each year a tree adds a new layer of wood on its trunk and its branches. This makes a ring. We try to count the rings in this trunk, but give up after reaching one hundred and fifty. The men tell us that trees sometimes live to be more than a thousand years old. Many of the trees in this forest



The logs are loaded by machinery

Photo by U. S. Forest Service



*Railroads carry the logs to the edge of the stream.*

have been standing here for two or three hundred years. Some were tall saplings when Columbus landed in America more than four hundred years ago.

Now other lumbermen have come up with their tools. We watch them cut off the branches and saw the tree into logs, twenty, thirty, and even forty feet long. They mark the ends with the camp brand, so that later on at the sawmills their logs may be kept apart from the logs of other

camps. Steel ropes are wrapped around each log. A "donkey engine" drags them down the wide roadway to the camp railroad. Here the logs are lifted into place by machinery. Some of them are so big that one is a heavy load for a flat freight car. This little railroad carries the logs to the edge of the stream down which they will float to the sawmills.

Chris tells us that one year he worked in the lumber camps of



Michigan. The forests there are covered with snow all through the winter and the streams are ice bound. Roadways are first cut through the woods and then covered with water which freezes to ice. These make huge slides over which the logs, loaded on sleds, may be drawn by horses. The trees of the Northern and Cen-

tral Forests are so much smaller that many logs may be loaded on a car at one time. They are carried down to the banks of the streams, where they lie in piles waiting for the warm breath of spring to thaw the thick ice. Then they are rolled into the water and floated on to the mills.





## CHAPTER 5

### DRIVING A LOG TO MARKET

“When with the sounds of smothered thunder  
On some night of rain,  
Lake and river break asunder  
Winter’s weakened chain,  
Down the wild March floods shall bear them  
To the sawmill’s wheel,  
Or where steam, the slave, will tear them  
With his teeth of steel.” — *Whittier*

WE have left our lumber-jack friends of the logging camp and have flown in our airplanes to the edge of the mighty Columbia River. Here we shall see the logs from the deep forests start out on their long swim to the sawmills which turn them into the lumber we use in our houses.

What masses of logs there are everywhere! They are coming down from the forests by railway and stream. They seem to march into their places in piles on the shores like an army of soldiers. Over at one side is a

huge trough of boards which has been built down the hillsides to the banks of the river. The waters of mountain streams are made to flow through it so that they can carry with them a steady procession of logs. This trough is called a flume.

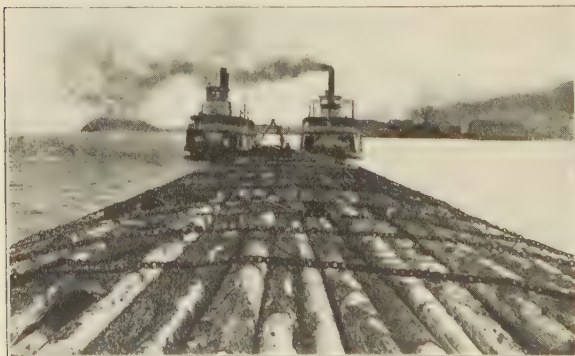
See those men! They are making a giant raft of logs. We stand on the bank and watch. They have built a huge wooden frame shaped like a cradle. They are filling this with logs and wrapping them with iron chains to hold them in place. We ask one of



There are masses of logs everywhere

the men what will become of this raft. He says it will float down the Columbia River out to the ocean. Then it will be towed

by a small steamer to a sawmill on Puget Sound. Jack wants to know if all logs are sent forth in rafts like this one.



Log raft on the way to the sawmills

"No," is the lumberman's answer. "In many places logs are floated loose down the streams. Men go along with them to keep them always moving. These men are called log drivers. They drive the logs before them just as a farmer drives his sheep or his pigs to the market.

The log drivers carry long poles with iron hooks in the ends. They wear shoes with spiked soles to give them a firm footing. Often a log is caught fast in the rocks or goes off to one side. Then they hook it back quickly. They fear the other logs may float down upon it and pile up on each other.



Drivers stand on unsteady logs

This would form a log jam."

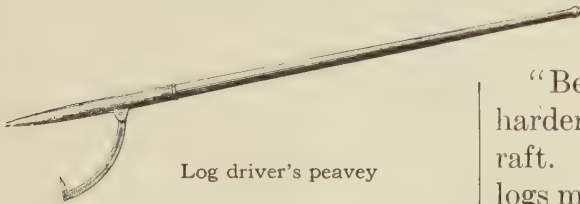
"How do they get the logs loose when they jam?" Mary asks.

"It is hard work," the logger replies. "The drivers stand upon the bobbing logs and jump from

must take care not to be crushed by the logs and not to be drowned in the rushing stream. If the jam is very large, they may have to use dynamite to loosen those logs which hold back the others."

"Why aren't all logs shipped out like that?" Bob inquires.

"Because that way is so much harder than taking them out in a raft. If the river is deep and the logs must go a long way, we make the rafts you see here. Also, we could not send our logs loose into the ocean, for they would get lost."



Log driver's peavey

one to another. They pull them and push them with their long hooked poles. Sometimes a man falls into the icy cold water. He





Ships taking on lumber

We walk with the logger along the bank of the river. Here and there we climb up over log piles, and at last come to a place where a raft is ready to start forth on its travels. The raft looks almost as big as a huge ocean liner. There is a hut or shanty built of rough

boards on one end of the raft. In this the men will eat and sleep during the trip. We watch the log drivers run about over the unsteady logs. We wonder how they keep their balance so well. We should like to go with them, but we know that the danger is

far too great and that we should be in their way. So we wave good-by with our handkerchiefs, and shout that we shall meet them later at the sawmill.

### The Trail of a Log

Our airplanes bring us down over the Columbia River and out to the shores of Puget Sound. We fly above many mills on the way. In all lumber regions there are sure to be sawmills.

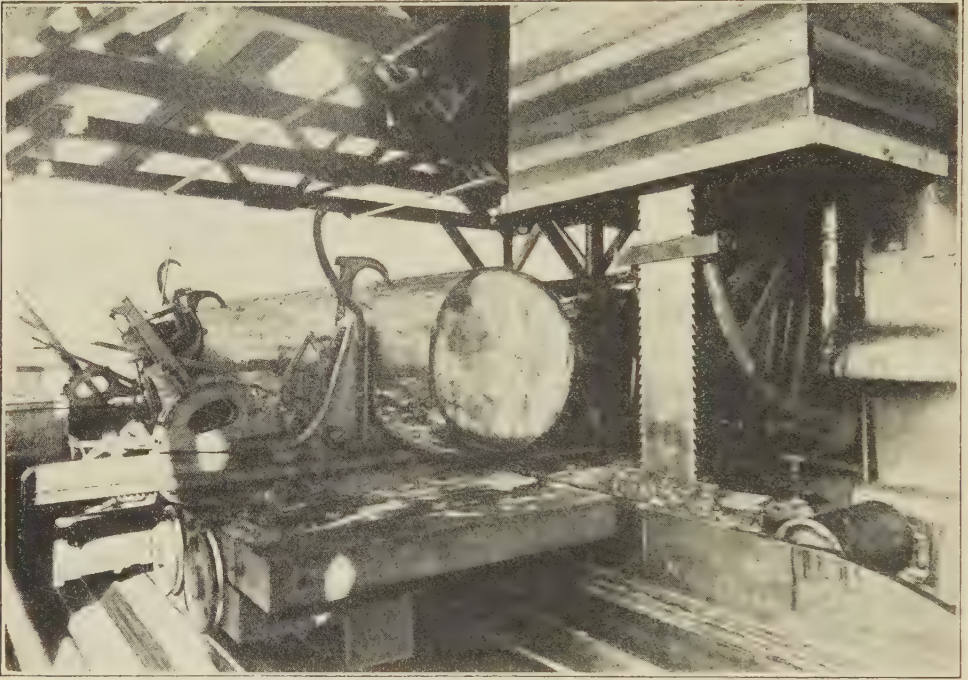
As we glide over the docks of the Puget Sound ports we just miss the masts of ships taking on lumber for shipment all over

the world. We come to earth not far away from one of the biggest sawmills of this western coast. At one end of its plant there is a body of water filled with loose floating logs. This is called a boom. Here the logs lie while men sort them according to the camp brands marked on their ends.

"Look at that log!" Dick cries. He points to a huge fellow about thirty feet long and as big around as a millstone. "See, there on the end is the mark of the lumber camp we have just visited. Let's follow its trail as it goes through the mill!"



Our log is crawling out of the water



A band saw cuts our log into square timbers

Soon our log is crawling out of the water into a wood trough or chute which leads up to the saws. We see that the log is being dragged by the iron hooks on those moving chains. It turns this way and that like a huge crocodile as it climbs the board runway.

At the top it is rolled out on a truck that runs upon rails. We walk beside it as it moves over the tracks toward the great saws. The saws are bands of

steel with sharp teeth cut in their edges. They are whirring round by machinery so fast that we cannot see just how they work. Everything here is moved by machines and the noise is so great we cannot hear ourselves speak.

The head sawyer of the mill comes and stands close beside us. He has charge of the cutting up of the logs. He takes care to get the most lumber out of each one. He nods to the workmen who are running the saws. A pull of



a lever and our particular log is thrust forward against the edge of the whirring steel band. Buzz, buzz, the sharp teeth eat their way hungrily through the bark and the wood. In the wink of an eye a great slice is pared off one side of the log. Strong iron hooks now roll the log over so that this time the saw will slice off the opposite side. Again and again the log is turned round. The top and bottom are now cut away. This leaves it in the shape of a long square timber. The sawyer tells us that the slabs which have been pared from its sides will be used for laths and many other things for our houses.

We next see the timber sliced into boards. It is carried by machinery against several saws at one time. These saws are set side by side, just the right distance apart, so that when they have whirled their way through the timber, they leave it neatly divided into flat boards. At other places in the mill the sawing

reminds us of cutting bread for our lunches. Here the saw slices off one board at a time. Each timber must be pushed against its teeth again and again.

From the sawing we follow the boards through their planing and smoothing. We see them go into



Circular saws

the finishing machines. They come out from these in the many different forms in which they are wanted for building our homes. At one place in the mill, men are running machines which shave balsam wood into a kind of wood wool. They tell us this is used for packing between the floors and the walls to keep our houses warm.

At last the trail of our log leads to the drying rooms. These are

called kilns. They are chambers lined with steam pipes whose heat takes the moisture out of the

As we stroll to our airplanes, we walk between huge piles of lumber lying out in the sunshine.



Balsam wood is finely shaved wood [Edith, Bob, Mary, Dick, Jack, and Helen]

green wood. It does this work much more quickly than will the sun's rays. But the sawyers say that lumber dried out of doors in the fresh air is often preferred.

The boards are stacked up in such a way that the air may touch every side. They are neatly arranged along wide streets and alleys. We climb about over the

lumber and some of the boys perch high in the air on the very top of the piles. Here and there trucks and wagons are being loaded and unloaded. A little railroad runs through the streets of the yard. The boards can be put right into the



We go through the drying yards .

freight cars for the last lap of their journey from forest to house.

In our travels we have gathered samples of wood for our Museum. We have pieces of yellow pine from the eastern part of our country. This is the wood used most

in our building. Then we have white pine from the Northern Forest, and Douglas fir from our camp in the Northwest. We have also bits of hard woods from the great Central woodlands.

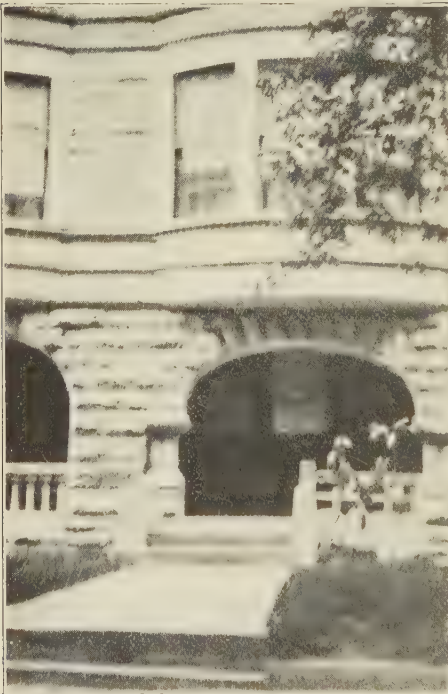




## CHAPTER 6

### A VISIT TO A STONE QUARRY

WE have chosen Bob as the host for this Journey Club meeting because he lives in a house built of stone. To-day we want



Bob's house is made of stone blocks

to find out about the stones in such houses and in the stone foundations of our buildings of wood.

As we run up Bob's steps, we look at the walls of his house. The stone blocks are tightly cemented together with mortar and plaster. Jack cannot find an opening big enough to take in even the point of his knife.

No one knows just how stones first came to be used to make shelters for men. It might have happened like this. Long, long ago men lived in caves in rocks or in rough tent-like shelters, built of small trees and branches. One day a clever man found that he could pile small stones, one on the other, and so make the walls of a rude hut. Perhaps he laid upon these walls branches which he broke from trees. These formed a roof. By fitting the



A hut with walls entirely of stone

stones closely together and stuffing moss and mud in between them, he made his house far drier and warmer than the houses of his neighbors.

We can imagine how proud he was and how he boasted to all of his friends: "My house of stone will last longer than any shelter built of wood. Stone does not burn like wood, and the weather will not cause it to rot and crumble to pieces."

#### Stone Temples and Tombs of the Past

On former Journey Club travels in Egypt we visited the famous city of Cairo. There on the edge

of the desert we saw the mighty Pyramids. These are mountains of stones which cover the tombs of old Egyptian kings. They are made of stone blocks that were laid one on the other thousands of years ago. We climbed part way up the side of the Great Pyramid, the largest of all. Its stone blocks are so huge that we had to be lifted from one to another by dark-skinned Arab guides.

Each pyramid has four sides which slope upward and inward. These sides once ended in a point, but it has disappeared, leaving a square platform hundreds of feet



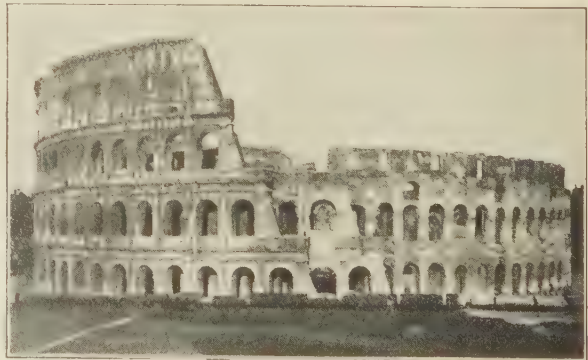
We climb part way up the Great Pyramid

above the sands of the desert. We wondered how the ancient builders could lift such huge blocks of stone. Our guides told us it took one hundred thousand men twenty years to lay up the two million blocks in the Great Pyramid.

Jack reminds us that in Central Park in New York there is a tall shaft of stone which was brought

there from Egypt. Its four tall sides end in a point. It is called an obelisk. It is covered with carvings which tell the story of why it was made. This Egyptian obelisk is one great piece of stone. Our Washington Monument on the banks of the Potomac River is an obelisk in shape, but it was built of thousands of granite blocks fitted closely together.

Many wonderful palaces and temples of stone were built in Greece and in Rome hundreds of years ago. The finest white marble and purest of granite were used in their walls. Parts of them still stand to-day. We shall try to visit their ruins as we go on with our travels. We want specially to see the Parthenon at Athens and the Colosseum at Rome. The Parthenon was one



The Colosseum at Rome





The pyramids are mountains of stone

of the most beautiful temples on earth. It was used for the worship of the gods of the Greeks. The Colosseum was a vast open-air theatre where the Romans watched bloody battles between wild beasts and warriors. Chariot races and sports of many kinds were held in its arena.

Among the famous temples and tombs of the world, we must not forget the Taj Mahal. We saw this fairylike building at Agra in India. Its white marble domes float like creamy bubbles against the blue sky. Inside it are some carved marble panels which look

like fine lace, and in some of its walls are designs made with semi-precious stones.



The Parthenon at Athens

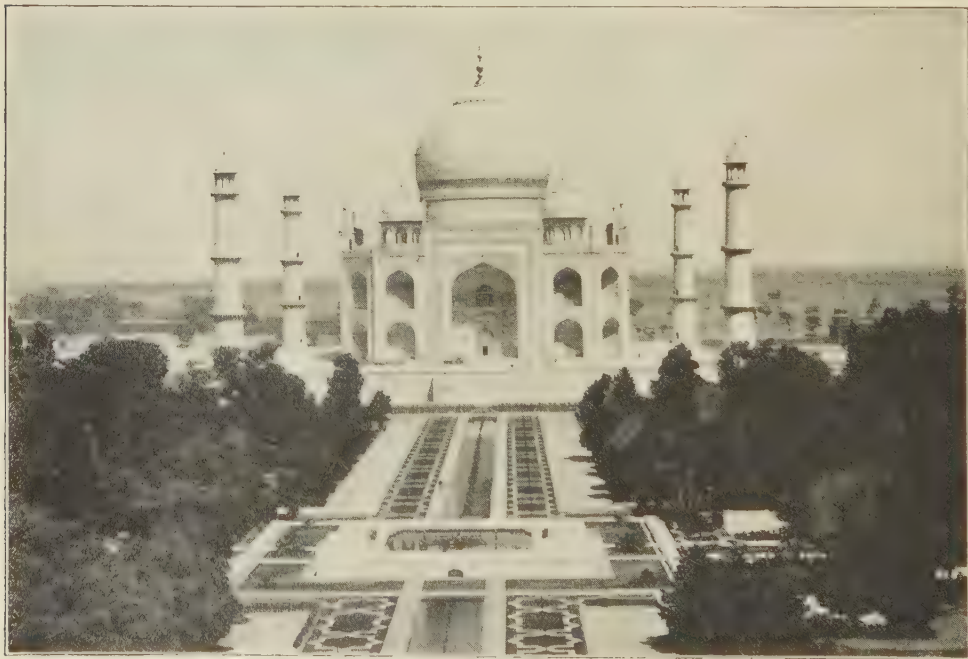
Wherever we travel, we find that the most splendid palaces and temples are usually made of some kind of stone. Stone was at first used only for such buildings and the homes of the rich. Getting it out of the earth and laying it in place cost a great deal. To-day with our vast quarries, our modern machinery, and our railroads it is much cheaper.

#### Our Building Stones

All the members of the Journey Club have now arrived.

Each has brought with him a different kind of stone used in building. We pass them around and tell what we know about them. Helen shows us a piece of light gray stone.

"This is granite," she says. "It is the strongest of all. It will last far longer than any other. Granite is used for high office buildings, hotels, great stores, bridges and piers, apartment buildings and fine houses. Whenever strength is important the builders choose granite."



The white domes of the Taj Mahal float like bubbles against the sky

Other members of the Journey Club have pieces of granite of several colors. There is white granite and black granite, some red and some green. Granite lasts so much longer than other stone that it is considered the best for making tombstones and grave-markers. We can find granite in almost all of our New England states, and also in some parts of our South and West. The famous Bunker Hill Monument in Boston is of granite from a quarry in Massachusetts.

Dick hands around a white stone. This is limestone. He tells us some of the things he has found out about it. He says:

"Limestone is used more than any other building stone. About one third of all the stone taken out of the earth is like this I have brought. Limestone lasts longer than any other stone except granite. Besides building our foundations and houses with it, we burn it to make lime and cement, and we use it in smelting iron and lead, and for some kinds of glass. We also crush it to build roads. In its finest form, it is the beautiful marble that decorates our fine buildings."



The Bunker Hill Monument is of granite

Paolo, our Journey Club member whose home was, until lately, across the Atlantic in Italy, has brought a handful of tiny pieces of marble. They are pink, red, and yellow, gray, green, brown, and black. Some have different colors running through them in



veins like those on the back of your hand. Color in marble comes when it is impure and other things are mixed in with it. Paolo has one piece of really pure marble. It is so white, it looks like a big lump of sugar. He says this bit came from a quarry in his native land.

"Years ago," Paolo explains, "the purest marble of the world



Country house made of stones from the fields

was found in the town of Carrara in Italy and on the Greek Island of Paros. The finest statues were always carved from this stone. The United States used to buy its marble from Italy. But to-day our American quarries give marble that is even purer than that of Carrara. There is so much here that there is now no need to bring more over the sea."

Mary recites a verse of a well-known poet as she holds up before us a chip of brown sandstone. It runs —

"Little I ask; my wants are few;  
I only wish a hut of stone  
(A very plain brown stone will do)  
That I can call my own."

We look at the stone Mary has and see that it is made up of fine grains of brown sand, fastened together by old Mother Nature. Most towns have sandstone in the country nearby, and many of our fine houses are built of this stone. We can see long rows of "brownstone fronts" in New York or in almost any other of our great cities.

Jack has brought a bit of gray slate. This stone goes mostly on the roofs of our houses. It lies in the earth in many flat layers and can be easily split into very thin sheets. The slate sheets are cut into squares and laid like shingles on the framework of our roofs. Edith says she will ask her teacher at school if their blackboard also is not made out of slate. Her grandfather learned to write on a

square piece of black slate in a wooden frame. Paper was so costly when he was a boy that all school children used slates for writing their lessons.

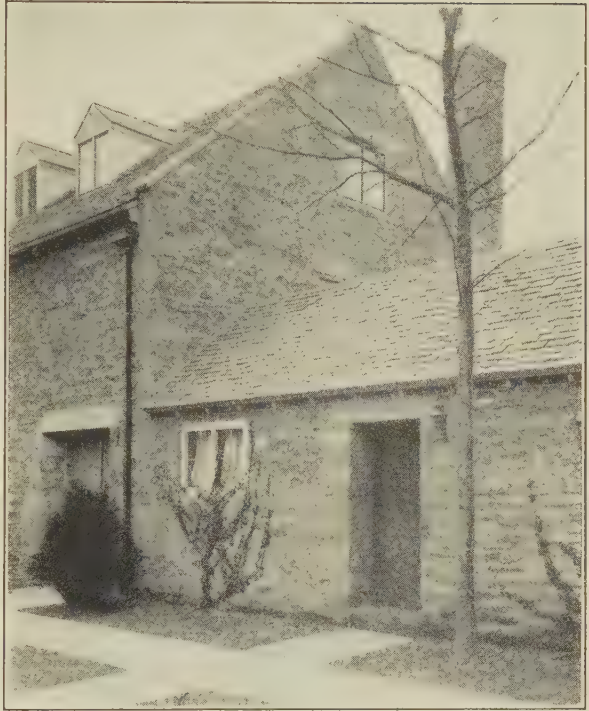
We put these samples of building stones in our Journey Club Museum. Each one has its place in giving us our stone houses. Each builder must choose the stone which is the easiest to get in his neighborhood, and the one which will best stand the heat and the cold, the rain and the hot rays of the sun. Stone must be able to stand all kinds of weather if it is to be good for building.

#### We Explore a Marble Quarry

"I love the stony pasture  
That no one else will have ;  
The old gray rocks so friendly seem  
So durable and brave."

— *Bliss Carman*

Almost one hundred years ago in Rutland County, Vermont, there was a hilly pasture field where sheep roamed about graz-



House with slate shingles

*Rising & Nelson*

ing on sparse bits of grass which grew between masses of ragged white rock. The land was thought to have no value at all. One day a man named William Barnes offered to trade for it an old rawboned horse worth about seventy-five dollars. The owner of the land was happy to sell it for this. Mr. Barnes planned to burn the white stone to make lime. But he soon found that it was the purest of marble, and the old pasture field



We ride out to Mr. Barnes' old sheep pasture [Dick, Edith, Mary, Helen, Jack, and Bob]  
[ 64 ]



is to-day a great quarry worth millions of dollars. It is this quarry the Journey Club plans next to visit.

Rutland County, Vermont, has the biggest marble quarries of the

gladly and ride with him out to Mr. Barnes' old sheep pasture.

Here we are! We jump down from our truck and look about us. Gone is the sheep pasture of the past! In its place is a huge



A marble quarry in Oregon

whole world. We have other great pits in our South and West. But Vermont stands first as "the marble state." We make our journey to the city of West Rutland by train. We ask the way to the quarries of a man who is standing just in front of the railway station. He offers to take us there in his motor truck. We climb up into it

yawning pit. This is the marble quarry. We stand on its edge and peer down into its depths. A quarry is not like a mine, hidden away under the ground. It is a great open hole dug in the earth. This one is almost five hundred feet deep. Far down at the bottom we see tiny specks moving about. They are the marble-workers. They are so far

below us that they seem no bigger than ants. Here and there are puffs of smoke. These come from the engines and machines

by the workmen and watch them direct the machines which do most of the work. Over there is a man drilling holes in the rocky



Lifting a giant block with steel ropes

which are used to hew off the blocks of white stone.

We climb gingerly down to the floor of the quarry, following a marble-worker who shows us the way. Once there, we stand

side of the pit. Now he is putting pointed wedges into the holes and driving them in by machine. Soon this splits off a giant block of white stone. We ask how such a heavy chunk can be taken out



Marble loaded on freight cars

of the quarry. The driller points up to the very edge of the pit. There, high above us, are the lifting machines made of the strongest of steel and iron. They are called derricks. See! A great black arm is swinging out over the edge and is stretching its claws down into the pit. Its fingers and ropes of steel pick up the huge block as though it were just a lump of white sugar. Clank, clank, clank goes the machinery, and up, up, up goes the stone.

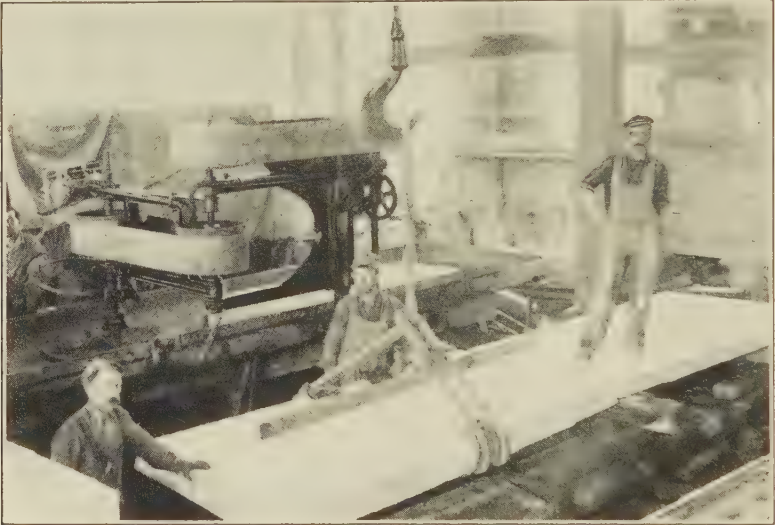
The driller tells us that years ago dynamite was used to blast down the marble. But by that way much good stone was lost. The machines of to-day get it out with but little waste. Paolo is much surprised at these machines. He has visited the marble quarries in Italy, where some of the work is still done by hand, and where the heavy stone blocks are hauled out by slow-moving oxen. He says the machines here are very much quicker.

We have now come again to



the top of the quarry. We are standing beside the derrick which lifted our block of marble up out of the pit. The steel claws set it gently upon a railroad car which takes it with many other blocks

the sun on so much white stone almost hurts our eyes. We pick our way among heaps of marble scraps left from the cutting. The millmen say that their marble goes out in many shapes. It is



Machines shape and polish the great blocks

like it to the cutting and polishing mill close at hand. Here again are wonderful machines which pare the great blocks to shape and polish them smooth. The marble is then ready to be loaded on freight cars and shipped out by the railway which here runs to the very doors of the mill.

There is marble everywhere about the quarry. The glare of

much used for floors, staircases, and doorways. Huge marble columns are turned out by machines, like so much soft wood. Especially fine blocks are bought by our sculptors for carving their statues.

Our friends, the marble-cutters, say that granite and sandstone are quarried and cut in much the same way as marble.

## CHAPTER 7

### STONES MADE TO ORDER

OUR trip to the marble quarry is over. We are back again in our own town and are walking through its streets on the way to our homes. As we go, we point out the different stone houses we pass.

"Here is a granite apartment building," Dick says; and Mary adds quickly, "And that house next door is built of white limestone."

"Look!" Jack cries out. "Over there across the street they are building a new house. What kind of stone is that they are using? Let's go over and see!"

As we come nearer, we find that the house is being built of smooth gray blocks which indeed seem like stone. We look closely at some of them piled on the ground. We see that each is a block with

hollow spaces running through it. We ask the head builder what stone this may be.

"It is artificial stone," he replies. "These are blocks of concrete. You see, old Mother Nature takes thousands of years to form the real stones we take from the quarries. She puts her stone masses so deep in the earth and she holds them so tightly that it takes us a long time to tear them from her grasp. Then we must cut them and shape them before they are ready to use in our houses. Real stone costs a good deal. So we have found out how to make stone ourselves much more quickly and at a far lower price."

"Do you really make stone?" Bob asks.

"Not really," is the answer. "For Mother Nature herself



Each cement block has hollow spaces through it

makes the materials. We just put them together. It is quite easy. Stone blocks like the ones we are using to build this house can be formed in a few hours instead of thousands of years. And we can turn out our stone in just the shapes that we want, all ready for use. This saves us the trouble of cutting and polishing. We can even make our stone blocks to order for the house we want to build. Sometimes we

number each one so that we can know just where it belongs."

We ask the builder to tell us how such stone is made. He replies that the secret is in the cement. He says:

"Have you ever mended your toys with glue or paste? Glue and paste both are kinds of cement. A cement sticks things together and holds them tight to each other. Concrete is made of sand and gravel or bits of rock cemented together so firmly that they become almost as strong as real stone. Each tiny pebble and each grain of sand is coated with a film of cement. When this grows hard, no part can break away from the others."

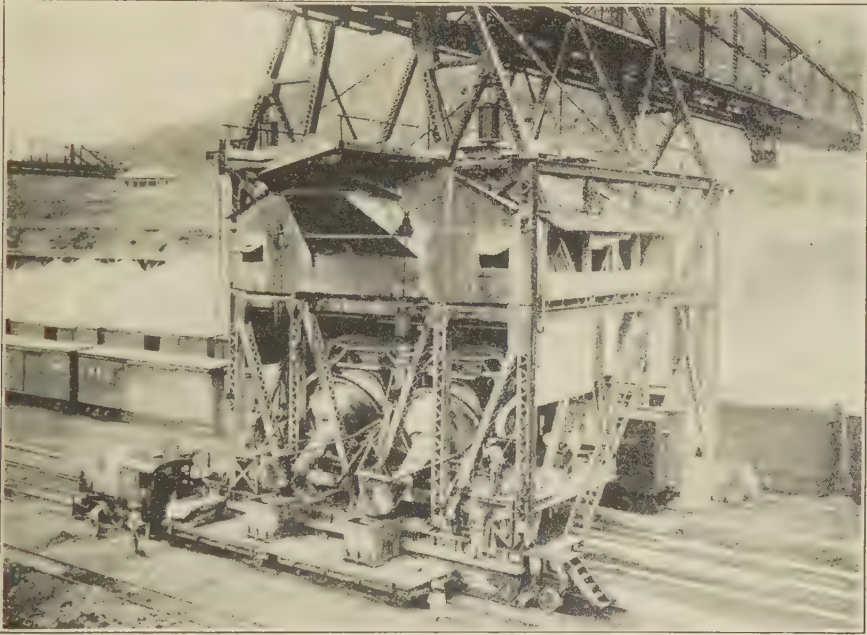
The builder takes us over to watch the stone-workers, or, as he calls them, the masons. They are laying up blocks of concrete one on the other in four smooth walls. We see that they smear between each block a thick grayish mixture which looks somewhat like mud. They call this mud mortar. Mortar is a paste of sand and cement stirred up in water to just the right thickness. It hardens soon in the air, and it holds the stone blocks so



firmly in place that they cannot budge.

We want to see for ourselves how concrete is mixed. The builder tells us where to go, and we spend the afternoon in finding

used wherever they can be had. We see the sand, gravel, and water poured in at one end of the mixing machine. That grayish powder which is also put in is the cement. What a noise the



Huge machines mix concrete

out how men can make stone so much more quickly than Mother Nature herself.

It is interesting to watch the machines which do most of the work of mixing concrete. We are told that in some places concrete is still mixed by hand, but that these machines are now

mixing machine makes as it shakes its mixture about! Soon the wet concrete flows out of its mouth. It looks like the grayish mortar the stone masons were using except that it is not quite so fine nor so liquid.

There are several kinds of cement for making concrete, but

the one we use most is called Portland cement. It gets its name because it makes concrete that is like a building stone found on the Island of Portland over in England. Our Portland cement is a certain kind of rock ground to a powder and heated till dry. The dried powder is ground again with great care and then put up in bags and barrels for sale to the builders. After being mixed with water, this cement will harden quickly to rock.

Over at one side men are molding the concrete blocks. The molds are like open boxes. We see that their sides can be lifted or dropped by machinery. Look! Here is one being filled now. The bottom of the mold is first covered with the wet concrete that has come from the mixing machine. Then a wooden box is laid crosswise through the center of the mold. This makes the hollow space we noticed in the pile of building blocks. Now the workmen are putting in more of the wet concrete mixture. They pack it tight in the mold. It fills every cranny. When the sides of the

mold are lifted carefully off and the inner box is pulled out, we have before us a hollow block of soft wet concrete. The block must be dried slowly and with great care so that it may come out perfectly smooth. The workmen tell us they often mold figures in wet concrete and sometimes even make fancy designs on the sides of great blocks. These are used to adorn fine buildings and bridges.

We have an interesting chat with the concrete makers. They tell us that artificial stone has been known since the days of the old Romans, thousands of years ago. The concrete we make today is far better than theirs. In some of our buildings where the walls are to be of solid concrete, steel rods are put in place in the giant wooden molds and the wet concrete mixture is poured in around them. This keeps the concrete from cracking and makes the walls especially strong. We call this reinforced concrete. Concrete is also used for our sidewalks and for paving our streets.

We find that the plaster on the inner walls of our houses is one of

the other forms of this man-made stone. Mary speaks of the stucco which covers the outer walls of some of our houses. Stucco is often molded in beautiful designs to finish our doorways, our walls, and our ceilings.

The concrete-molders make a

tiny block for our Museum. They carve out of wood the letters



Our concrete block

J. C., to stand for the Journey Club. They lay these in the bottom of a small molding box and fill it with wet concrete.

When the mold is removed, the letters are stamped in our wee block.





## CHAPTER 8

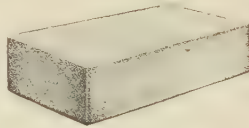
### THE STORY OF A BRICK

"GUESS what I have brought for our Museum!" Dick says as he comes in to the Journey Club meeting. He shows us a package wrapped neatly in paper. "It is artificial stone and it is made out of clay. That's all I will tell you."

Mary is the first to guess. "I know," she cries. "It's a brick. I can tell by its shape."

Mary is right. Dick takes off the wrapping and lays on the table a brick of the kind we use for building houses, foundations, chimneys, and hundreds of other things. This brick is of a dull reddish brown. It is just eight inches long, four inches wide, and two inches thick. It was easy for Mary to guess what it is, for our common house-bricks are nearly always the same both in

shape and in size. They may differ, however, in color. Bricks are made in many other sizes for special purposes. Brick clay is

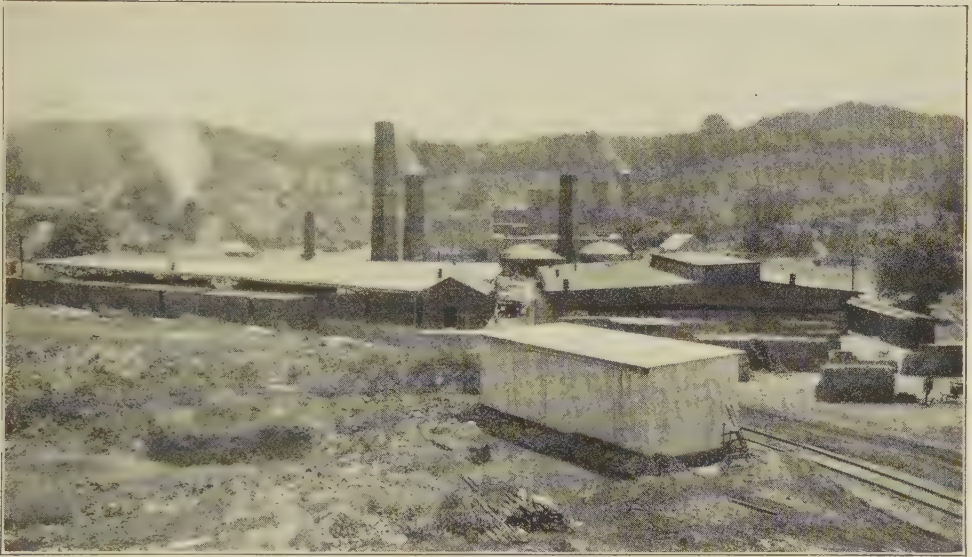


A common brick

found in all parts of our country; so almost every city and town has its own brickmaking yards. We see bricks,

either in streets or in buildings, every day of our lives.

We are tired with our travels to the stone quarry and the concrete works. We feel that we should like to stay at home today. Still we do want to find out how such bricks are made. We decide to pretend that Dick's brick can talk and can tell us its story. If one pretends hard enough, who knows what may happen? Listen. Can you hear what the brick's voice is saying? Its tale runs like this:



Every city has its own brickmaking yards

### The Brick's Family Tree

"My family is very, very old," says the Brick. "Bricks have been made for more than six thousand years. You can read about bricks in many parts of the Bible. The ancient city of Babylon had palaces, temples, and houses built of brick. Some of the modern homes in Babylon to-day have in their walls bricks from the ruins of these buildings of thousands of years gone by. The clay of the banks of the river Nile in Egypt was just right for brickmaking. The Egyptians mixed this clay with straw to

help hold it together. They molded their bricks by hand and baked them in the sun until they were hard.

"Here in your own country to-day, many members of our brick family are still dried in the sun. In the state of New Mexico where trees are few, lumber is scarce. Most of the houses are built of a mud called adobe. It almost never rains in that state and the mud bricks last a long while. Some of the adobe houses there have been standing for more than three hundred years.

"I am sure that the Journey Club has seen many brick buildings in its travels through other

"Paolo can tell you of the ancient city of Pompeii. That whole town was buried almost



Brickmaking in ancient Egypt

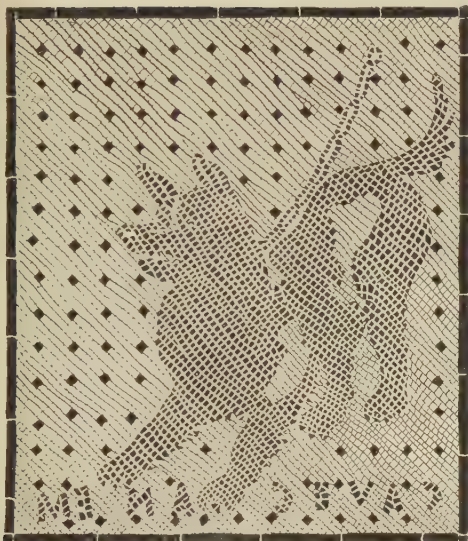
lands. You have visited China and Korea where people live in huts of mud brick. You must have walked on the top of the Great Chinese Wall which climbs over mountains and crosses deep valleys. Surely you remember how it is built. It has two separate brick walls which run side by side and not far apart. The space in between them is filled in solid with earth and stone. One brick from the Great Wall of China will weigh half as much as Mary or Edith. There are many walled towns in China and Korea and most of their walls are made of bricks.

two thousand years ago when the fiery volcano Vesuvius spouted out melted rock and ashes and covered it up as if with a blanket. Pompeii lay hidden for a great many years. When at last it was dug out, brick buildings of all kinds were found in the ruins. There were brick houses, brick doorways, brick ovens, and brick bathrooms. Some of the floors were of wee bricks laid in patterns of many colors. In



Bricks are still dried in the sun





A Roman mosaic

these the single pieces of brick were often no bigger than a twenty-five cent piece. Brick, stone, and glass laid down in such a way are called mosaics.

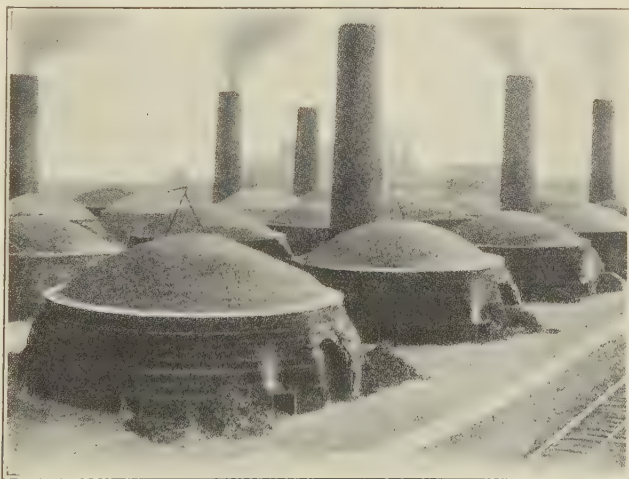
"We bricks are made all over the great world to-day. Here in America we are to be found in every town. New York, Pennsylvania, and Illinois turn out the most. These states make enough every year to give three hundred bricks to each man,

woman, and child in the United States. The town of Milwaukee, Wisconsin, is also especially famed for its fine brick.

"I suppose you think a brick is simple and easy to make. That is not the case. Just listen to all the adventures I had from the time I left my home in the earth until I became the finished brick you see now."

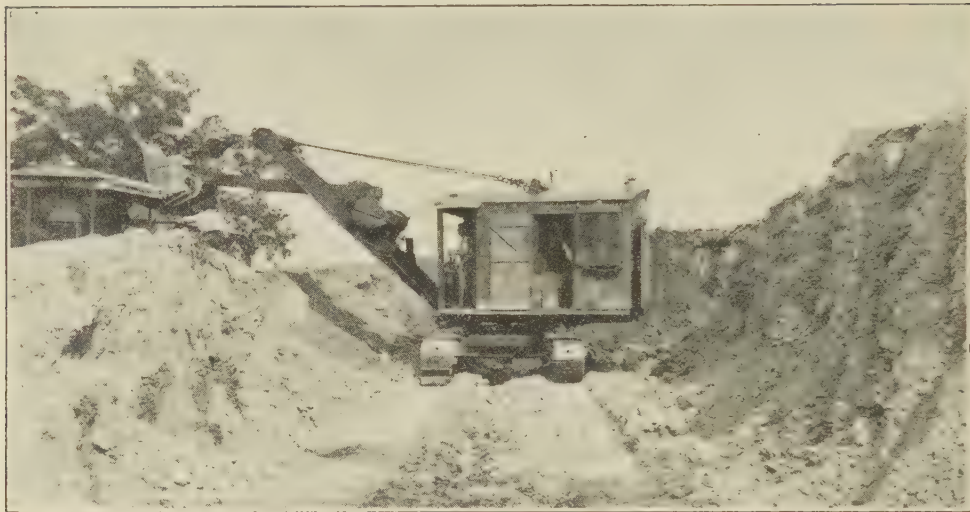
#### The Adventures of a Brick

"For hundreds of years," the tale goes on, "I was a part of a bed of clay and sand. One day there came men who tested our earth to find out if it would not be good for brickmaking. You see, brick clay must be pure,



Kilns in a brick factory





Steam shovels take out great bites of clay

except that there must be mixed with it one half as much sand as there is clay. If there is not enough sand, more must be added.

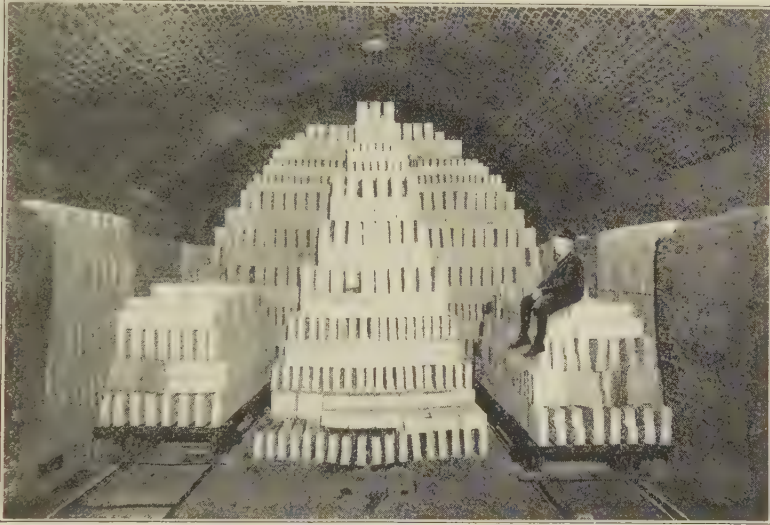
“But in our earth bed, the clay and sand were just right. It was not many days before huge steam shovels puffed above us and began to dig up the ground. They swooped down on our bed and took out great bites with their terrible jaws. In the brickyard from which I came, most of the work was done by machines. Our clay was first ground fine and put through coarse sieves which removed all the lumps and bits of

small rock. We were sprinkled with water and kneaded with knives whirling about, until we were of just the right smoothness and thickness. Then the soft clay was forced through tiny tunnels the width and height of a brick. When it came forth from these tunnels, it was in the shape of a long bar of wet clay. I was once a part of just such a bar.

“Have you ever seen a machine for cutting a ham into even slices? Well, we bricks were sliced almost like that. But instead of sharp knives, we were parted by taut wires set at just

the right distance from each other. These slid through our soft clay as neatly as a hot knife goes through butter. One after another we bricks dropped from the cutting machines to

After twenty-four hours we were brought out again. It did seem good to feel the cool air once more. But my pleasure was short. I soon found myself stacked up with thousands of my brothers



In the drying tunnel

a wide belt which was always kept moving. Other machines made our corners square and our sides smooth and even. Some of our friends in other brick-yards however are molded by hand or in little wooden boxes.

"With thousands of other bricks I was next loaded upon a small car and run into a drying tunnel. How warm it was there! We felt the heat on every side.

and sisters inside a giant oven. This oven is called a kiln. I had thought the drying tunnel was warm. But it did not compare with that terrible kiln. For more than a week I was bathed in blasts of hot air. Flames licked my sides. I was kept almost as hot as a red hot poker. In some kilns the bricks become white, the heat is so great. You can imagine that when I came from that



Handmade bricks drying in the air

kiln, I knew I was strong enough to stand any kind of weather or hardship. I remember it took me four or five days to cool off.

"I have heard from other bricks that sometimes the drying is done under sheds out in the open. Roofs keep off the rain and the bricks dry in the air. That way is more pleasant, but it is far slower than drying by fiery heat.

"You may think that all bricks are just alike,"

says our story teller. "That is not so. Of course most house-bricks like me are of the same shape and size. But in all, there



An old-fashioned brick fireplace





We inspect a brick house that is being built [Jack, Dick, Mary, Edith, Helen, and Bob]

are about one hundred different kinds of bricks; and we are used in more ways than you can count. My cousins, the paving-bricks, must be strong enough to stand the weight of wagons and trucks and automobiles. So their makers add lime to the sand and the clay. This makes them harder than I. The strongest of all my family is my brother, the fire-brick. He is so hard that he will not burn. Fire-brick is used to line ovens and chimneys and even great kilns which hold blazing fires.

“Facing-bricks for the fronts of fine city buildings are better finished than house-bricks. They are sometimes tinted or colored or even glazed so as to look like shiny glass. Tiles for mantels, for bathrooms, for roofs, and for hearths are related to me and are made in much the same way. Have you ever seen a piece of terra cotta? It is somewhat like brick clay and is often molded in fancy figures and then baked hard. Terra cotta is sometimes used to ornament handsome brick buildings. Even your pottery

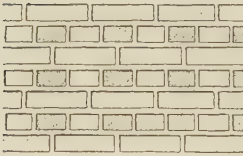


dishes and vases were once lying in beds of clay in Mother Earth's lap.

"Just think of the things we

out how they are put into all these buildings. We think after

all we had best go out and see some of them for ourselves.



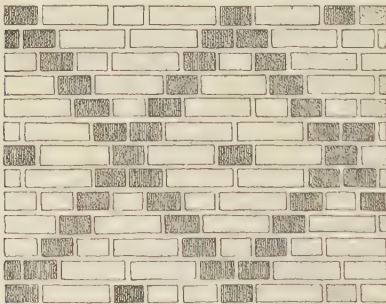
Bricks are usually laid in straight rows

bricks give to you! Count the apartments, the stores, hotels, and houses. Do not forget the schools and the churches, the roadways and sidewalks, the tunnels and chimneys, and the many other things and buildings you make from us bricks!"

When we have heard the last of Mr. Brick's story, we place him in the Museum. He stands

brick houses are being built. We climb up the rough board runways which serve as stairs for the builders. We run our hands over the smooth brick walls and peer down in the cellar to see the bricks in the foundation.

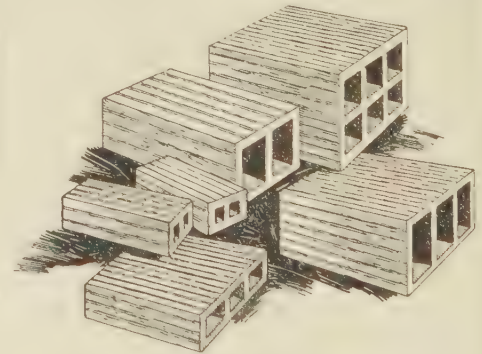
As we watch the bricklayers work, we think of the Arabian Nights story of Aladdin and his



Bricks laid in a pattern

beside our concrete block and our samples of building stone.

We now know how bricks are made, but we have yet to find



Hollow tile

wonderful lamp. Do you remember how he rubbed his lamp and called his slaves to him? They built for him a palace in

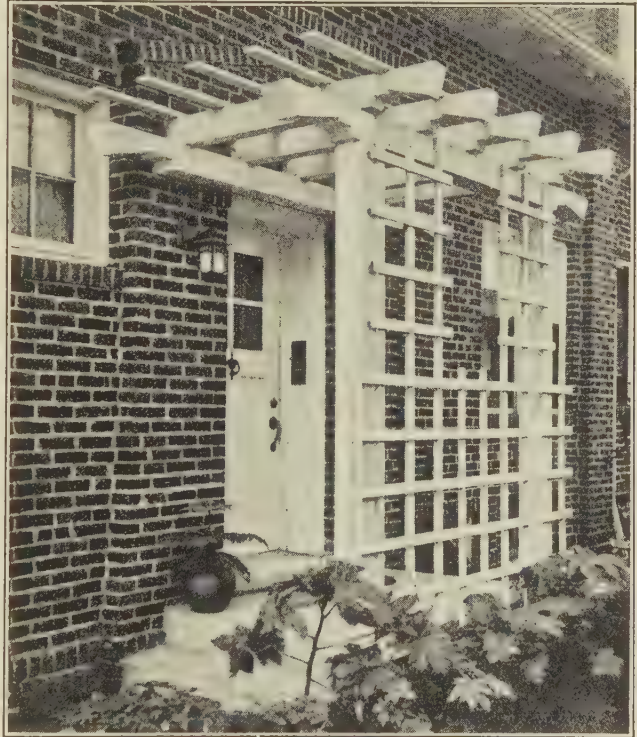
the wink of an eye. We feel like Aladdin as we see the magic worked by the hands of the bricklayers. They are turning those heaps of loose brick on the ground into a house even as we look on.

We see that the bricks are placed in straight rows. We are told they must be laid in such a way that the walls cannot crack. Those white spots on the overalls of the workmen come from the mortar with which the bricks are cemented together. The bricks are as carefully put into their places as are blocks of stone or concrete.

Up, up go the walls! Here and there holes are left for the windows and doors. Each bricklayer has a helper who brings him his bricks and mortar. The men tell us that in very high buildings these things are lifted up by machines. But here the helpers carry the mortar and bricks in small wooden boxes fixed

to the ends of poles. They lay the poles across their shoulders. The boxes are called hods.

We find there are several kinds



The brick house is finished

of brick walls. Some are of solid bricks. Others are of bricks with holes through their centers. The hollow spaces make the houses warmer in winter and cooler in summer. Sometimes thin walls of brick are built around a frame house. This is called brick veneer.

## CHAPTER 9

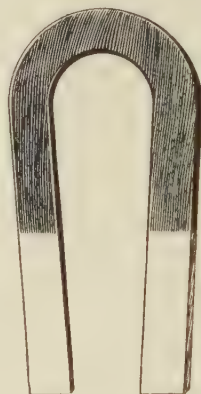
### WE FIND OUT ABOUT IRON AND STEEL

"COME along, Mary! Hurry up, Bob!" The Journey Club is ready to start off on a trip to find out about iron and how steel is made from it.

Dick has with him a little steel magnet. This is in the shape of a wee horseshoe. Its metal has been so treated with electricity that the ends of the horseshoe will pick up tacks, small nails, and any bits of iron or steel that come near them. The pieces of metal cling to the magnet just as a wet postage stamp sticks to your finger.

Suppose we might have a giant magnet so strong that it could draw to it all the iron and steel from our houses. Just think what would happen! Out of the boards would fly nails, screws,

and bolts. Off of the doors would come locks, latches, and hinges. Gone would be our stoves, our heating plants, and our tools, as well as many of our kitchen utensils. Hundreds of other pieces of hardware would be drawn to the magnet, and our houses would look as though they had passed through an earthquake. They would fall down in piles of loose boards and plaster. For it is really the nails and bolts that



A horseshoe magnet

hold our houses together. In great hotels and high office buildings which have frameworks of steel, there would be but little left.

From iron we get many other useful gifts. The machines and the tools with which we make all





We are going to see an iron mine [Mary, Bob, Helen, Edith, Dick, and Jack]

the things we eat, wear, or use are of strong steel or iron. The engines which run the machines in our factories, our automobiles, our trains, and street cars depend upon iron. Every time we take a trip with the Journey Club in a railway train, we roll over rails of glistening steel. Indeed, if we did not have iron and steel, we should have to go back to the ways of savage people, and we might have no better houses than that rough log hut which was the first home of the Pilgrim girl, Patience True.

We could get along better without gold or silver, copper or brass, than without iron. Iron is the most useful metal we know. Men have used it for thousands of years. No one knows just when iron was discovered. But its coming made such a difference in the lives of the people that the period when it first was made into tools is often called the Iron Age. Before the Iron Age the chief metal was bronze, so that was known as the Bronze Age. When Strong-as-a-Lion helped his father work with crude axes of stone, the times were called the Stone Age.

### In the Iron Mines

We might find iron mines in many parts of the world. Iron is everywhere. It is in the juices of plants and in the leaves of the trees, as well as in the earth's soil. Our own bodies have iron in the red blood in their veins.

In many parts of the United States there are iron mines. The most and biggest of all are in five ranges of mountains near Lake Superior. In this section is the Mesaba Range. It is the richest iron region of the whole world. It is there the Journey Club is going to-day.

A journey by train brings us to the city of Duluth, Minnesota, on the shores of Lake Superior. Here we must change cars to go out to the Mesaba Range. The station where we stop is a busy town with wide streets, fine schools, and comfortable houses. It is in the very heart of the mining region. We are soon packed in automobiles and are rolling over the hills. We notice that the earth here is much redder than that near our homes. That is because there is so much iron in the soil.

Here we are at one of the



An open-pit mine on the Mesaba Range



biggest of the iron mines. What a surprise! This mine is not down under the ground as we had supposed. One of the miners explains that in many of these Lake Superior mines the iron ore



Steam shovels spit the ore into cars

is so near the top of the earth that it is quite easy to scrape off the top soil and then to blast out the ore. He calls mines like this open-pit mines.

The open-pit mine before us looks like a valley, it is so big. Its red floor has railway tracks running this way and that over it. At one side men are blasting. Clouds of reddish brown dust burst forth and fly up into the air. Over at the right, engines are puffing and machines are screech-

ing. Hungry steam shovels grab up the loose ore which has been blasted out of the earth. See! There is a full shovel swinging around until it is just over a freight car which stands still on the tracks. Now the giant jaws of the shovel open slowly. They spit the ore out into the car.

Our miner friends tell us that this ore will go from here on the railway down to Duluth. Most of it will be loaded on ships and carried to the cities on the shores of the Great Lakes, and especially of Lake Erie. From those cities a great deal will be sent out on the railroads to the iron and steel district of Pittsburg, Pennsylvania.

Mary picks up a bit of iron ore. It looks like a piece of rusty brown stone. Iron is always found mixed with other minerals and rocks. It must be separated from them before it can be used. This is done by melting the ore in such a way that the iron comes out nearly pure. Such melting is called smelting.

As we ride over these iron hills we see many open-pit mines.

We find some underground mines too. Here the miners go down, down, down into the very heart of the earth. They blast the iron out in tunnels and shafts. Their ore is loaded on cars and brought to the surface by small elevators. This ore also is taken to Duluth by railroad to be shipped away to the steel plants. Jack asks one of the workmen why iron is not smelted here at the mines.

"Three things are needed for smelting iron," is the answer. "We must have besides iron ore, both limestone and coal. The furnaces take twice as much coal as ore, so that it is far cheaper to ship the ore to the coal than to

bring so much coal here to the ore. Down in Alabama, near Birmingham, there are beds of limestone and coal and iron ore as well. So the smelting can there be done quite near the iron mines. Here we have only the ore. So we must send it out to find its own coal."

### A Trip on an Ore Boat

What fun we shall have on our way to see the ore turned into iron and steel! We have been invited to make the trip to Chicago on one of the freight steamers which carry the ore from here to the smelters. Most of the space within the walls of our ship is



One of the lake steamers that carry ore to Chicago

given to a great pit which runs nearly the full length of the vessel. This is the hold, where the ore cargo is stored. There is not room for many passengers, but we shall crowd ourselves into the comfortable cabins kept for officials of the Steel Company which owns these freight steamers. A special cook will prepare our meals. We shall enjoy every minute of the trip.

Before we leave the docks we watch the ore pouring into the open hold. The ore is dumped from the freight cars into the mouths of great iron pipes. These pipes are called chutes. The ore flows down the chutes in rattling streams. It makes so much noise we cannot hear ourselves, however loudly we scream. When the hold is full, steel covers are clamped over its mouths. They make the central part of the ship just like a floor. During the trip we can run about over it and play all sorts of games.

Sailing on the Great Lakes reminds us of journeys over the ocean. For most of the way, we cannot see land. When a storm comes up, we are glad of our heavy cargo of ore which keeps

the ship steady. All too soon the journey is over and we are standing upon the docks at South Chicago. Our cargo of ore is unloaded by noisy machinery and is at last put in piles near the iron and steel works.

### Turning Ore into Iron

Our eyes open wide with wonder as we begin our journey to see our red ore changed to iron and steel. Everywhere we look are great ovens and furnaces. There are forests of tall smokestacks pouring clouds of smoke into the sky and almost shutting out the rays of the sun. Railroad tracks run from one part of the plant to the others.

We ask permission to follow a car load of ore on its way through the smelters. The Manager gives us a guide and we spend a whole day going over the factory. First we are taken to see a blast furnace. It is a huge cylinder of steel lined with fire-brick. It is almost as high as a five-story house. A fire is blazing inside it. We peer in through a little door but draw back in alarm lest the flames scorch our faces. Our guide explains that coke, a kind



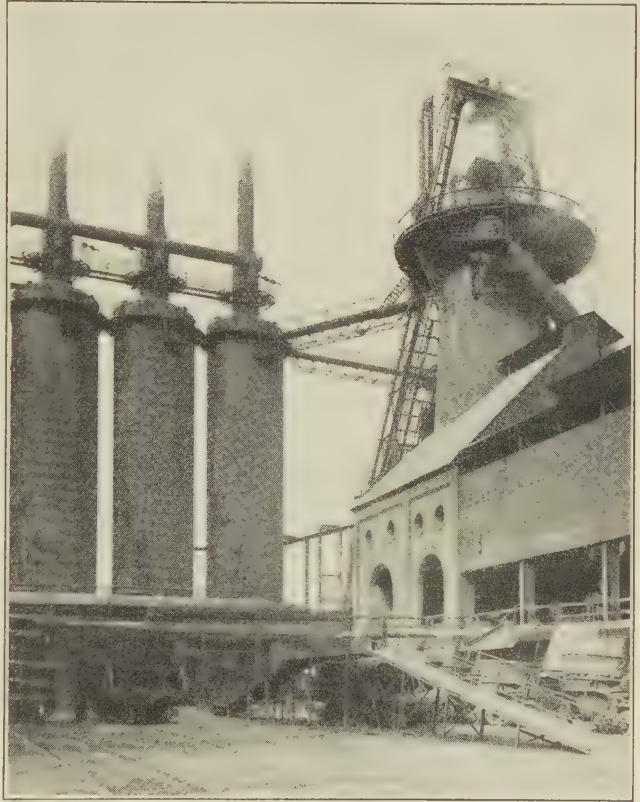
of roasted coal, is used in these furnaces. A coke fire is hotter than one made with coal.

Now machines are filling the furnaces with iron ore and limestone. Blasts of air are let in and the heat grows greater and greater. The roaring fire soon melts the ore and limestone into a bubbling mass of red-hot liquid.

"Watch this furnace," our guide cries. "It is ready for tapping. You see, the iron is heavier than the rest of the liquid, so it sinks to the bottom. The limestone and the other minerals from the ore float on the top in a kind of scum. We call this scum slag. The slag flows out through that door high up in the side of the furnace.

Then the iron will be drawn from that tap lower down." Edith asks what is done with the slag. Our guide replies: "We used to throw all the slag away, but now

it is made into cement for concrete and fertilizer for our fields. Or it may be crushed for covering the road beds on which railway tracks rest."



Blast furnaces are huge cylinders of steel

The tapping has now begun. Out flow streams of fiery red liquid. At this furnace the melted iron runs into rows of little straight trenches dug in



The slag flows out a door in the side of the furnace

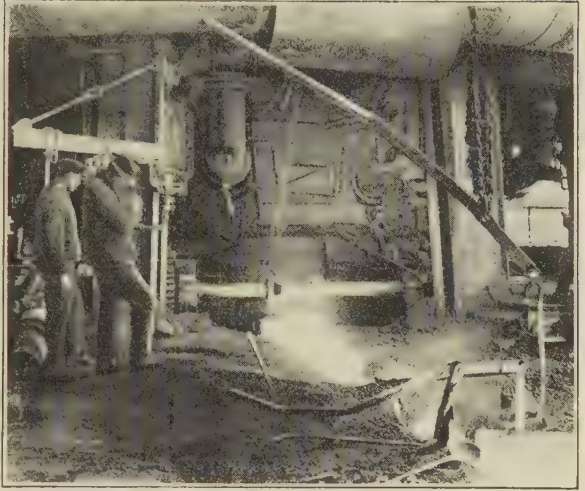
deep sand. In the air its red color soon turns to a gray. When the metal is hard we see bars of iron about three feet long and four inches wide. Our guide calls these bars pigs and says this is pig iron. The newest way to make pig iron is to run the molten iron into molds made of metal. These are taken by machinery through a bath of cold water. This cools the bars quickly and they are soon ready for their next adventure.

“There are three forms in which we use iron,” our guide says. “These are cast iron, wrought iron, and steel. They all come from pig iron. These pigs you see in their sand trenches are really a kind of cast iron. Cast iron is made by pouring the melted metal into a mold that will give it the desired shape. The iron brackets on our school desks and the stoves in our kitchens are molded in this

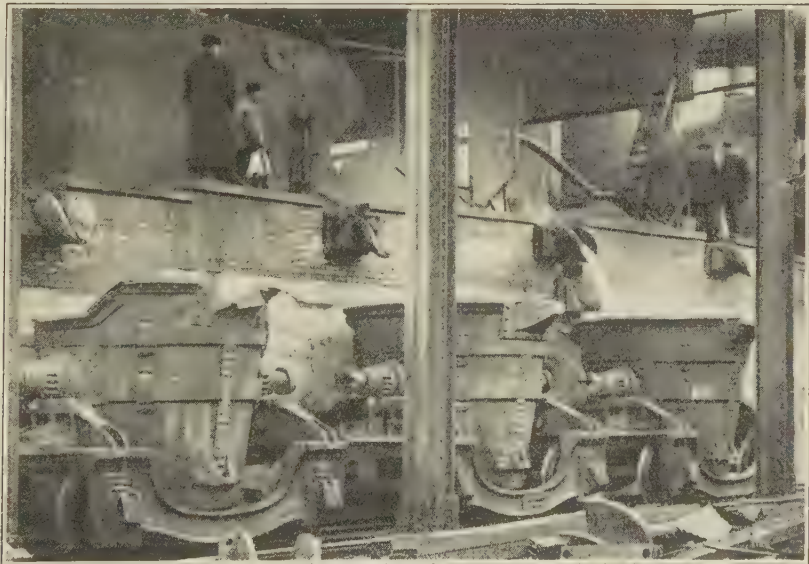
way. Cast iron is hard and brittle. It cannot be pounded without snapping to pieces."

We find that wrought iron is softer than cast iron. It can be rolled by machine or hammered to shape. Steel is stronger than either cast iron or wrought iron. It bends far more easily, but it is harder to break. Steel can be so treated that it becomes as soft or as hard as is wanted for making the thousand different steel things we

use every day. It can be fine enough for a razor blade or a



Out flows the fiery liquid iron



A train of ladles filled with molten iron



watch spring. Or it can be so hard and tough that it can be used for the making of plates to cover the sides of a battleship.

### How Steel Is Made

Look at the huge bowl under the tap of that furnace further along! It rests on a little car which runs on the railway tracks. See, the stream of molten iron is flowing into the bowl and filling it. Our guide calls the bowl a ladle. He says this molten iron will be made into steel. It is used while red-hot to save the work of remelting.

We follow a train of these ladles to see the iron smelted and turned into steel. Electric machines called cranes pick up the hot ladles as though they were tea cups, and pour the melted iron into the mixing tanks. The iron then goes into the steel-making furnaces. Other materials are added to the melted iron. Often one third of the whole mass will be scraps of old iron and steel put in with the metal that has come from the blast furnaces. In this way no iron need ever be wasted.

Our guide tells us that these



Open-hearth furnaces

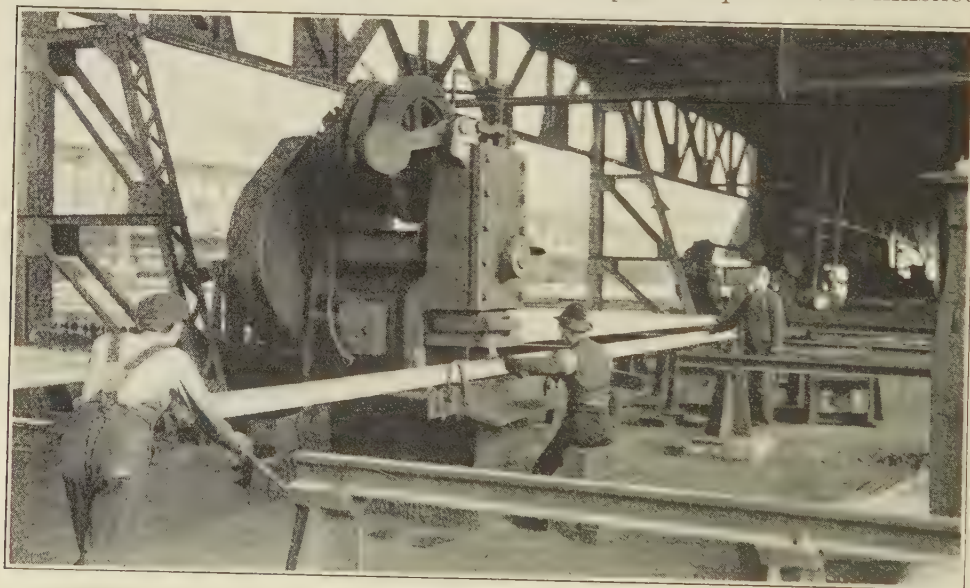


Bessemer converters are furnaces for making steel

steel furnaces at which we are looking are open-hearth furnaces. Their fires are burning gas instead of coke, as do the blast furnaces we have just seen.

We walk around to the other side and see the finished steel

"They are another kind of furnace for the making of steel," is the answer. "These furnaces are Bessemer converters. They are lined with fire-brick, and they are so made that the whole furnace tips and pours the finished



Heated ingots are rolled into rails

flowing out into more waiting ladles. Cranes carry these ladles to the molds into which the steel is poured out to cool. The bars of cooled steel are called ingots.

"What are those fireworks?" Edith asks, as she points to some giant steel eggs from whose tops clouds of sparks are flying up in the air.

steel into the ladles. They have holes in their bottoms through which drafts of air are blown. Showers of sparks fly out with each blast of hot air."

There goes a train of little cars. They are loaded with red-hot ingots. It is from such ingots that we get all the steel things we use. They are rolled into



rails or the finest of wire, or flattened into thin plates like pie crust under a rolling pin. It takes many men and many machines to turn these clumsy ingots into the finished steel articles needed for building our houses.

Steel can be made harder or softer by being heated again and suddenly plunged in a bath of cold water. This is tempering the steel. The hardness depends on the amount of heat used. Some steel is strong enough to cut glass and wrought iron.



## CHAPTER 10

### IN A HARDWARE STORE

For want of some nails  
A beam came loose.  
For want of a beam  
A wall caved in.  
For want of a wall  
A house fell down.  
And all for the want  
Of a few iron nails.

OUR journey to-day will not take us far. It is to be right here in our own town. We are going to pay a visit to our biggest hardware store to see the many kinds of nails, bolts, and screws, latches, and locks which are used in our houses.

The storekeeper, whose name is Mr. Ford, is interested when we tell him why we have come. He says he will be glad to show us every kind of hardware needed for building. The walls of his store are lined with drawers and boxes filled with

thousands of different things we use every day. All of these are made of some metal or other. There are bins of loose nails, shelves of shining kitchen utensils, and high up near the ceiling are hung the tools which are too large to be packed away on shelves or put up in boxes. We ask the storekeeper what is the most important thing he sells to our builders. He replies:

“Nails! They are more needed in building a house than anything else. Long, long ago when men did not have nails, the

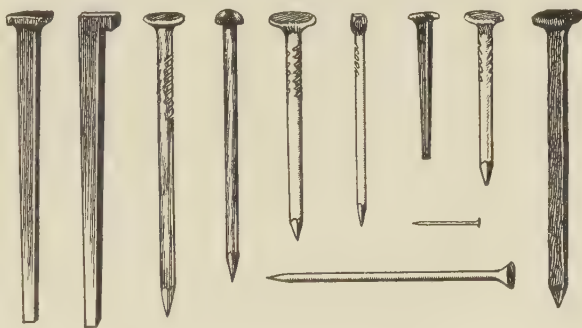
houses were held together with wooden pegs. In New Jersey, in my own grandmother's house, which is one hundred years old, the rafters and beams are spiked into place with pointed wooden pins six or eight inches long.

"The very first iron nails were made entirely by hand. In Europe and in the early days in America, bundles of small iron rods were sold especially for nail-making. Every house had its little anvil and forge, and all the work was done by the family. The women and children helped to heat the rods red-hot and to cut them in lengths of just the right size. They pounded each nail flat on one end and beat the other end into a point."

Mr. Ford picks up a nail about the length of Bob's little finger. He says:

"This nail was made by a machine which turns out almost a ton of nails every day. This is an iron nail. A bar of pig iron about three feet long and four inches square was heated and run through great rolling machines.

It was squeezed through the heavy rollers again and again. Each time it grew thinner and longer. At last the three-foot pig became a coil of rough wire one quarter inch thick and almost twelve hundred feet long. It was next heated and forced through a round hole in a block of



Nails are of all sizes

hard steel. The hole was just the size of this nail.

"The coil of iron wire was then sold to the nail factory. There whirring machines gobbled it greedily. In the wink of an eye they spit the wire out again in a stream of iron nails, all headed and pointed. You really should see one of these nail-making machines. The nails fly out like water from an open spigot. They come at a rate of one hundred and fifty to five hundred a minute



according to size. Other machines clean and polish the nails."

Jack asks to see the different nails here in the bins and drawers.

How many there are! They are of all sizes, from spikes as thick as your finger and as long as your hand to others as fine as the point of a hat pin.

There are wee carpet tacks and some even smaller for use on upholstery.

There are iron nails and steel nails and nails of brass, zinc, and copper. Mr. Ford says there are about three hundred different kinds used in our houses.

Edith tells us how the blacksmith who shoes her father's farm horses once made her a ring from a horseshoe nail. He hammered it around the small

end of his anvil and bent it into a circle just the size of her finger.

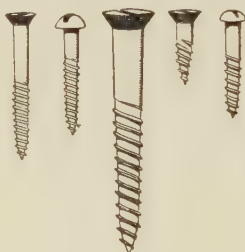
Horseshoe nails are of wrought iron. They are soft enough to be

cut easily into the length that will fit the hoof of each horse.



Edith's ring

Helen has picked up a screw from the counter. She runs her finger nail through the little groove which twists around and

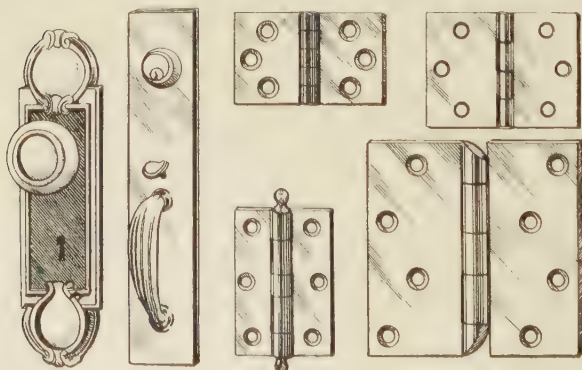


Screws

up from the point. The storekeeper shows us how this spiral cut helps the screw to eat its way down into the wood. He tells us that screws are made by machinery.

There are hinges of several kinds to be found in a hardware store. Most of them are of iron, steel, and brass, and they are of many sizes and

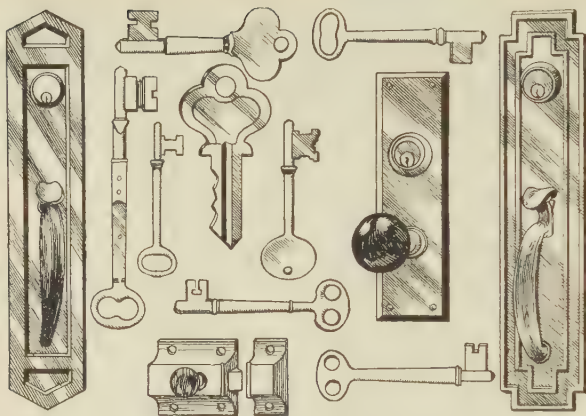
shapes. Mr. Ford explains that some hinges are made by pouring melted metal into molds. For others the shapes wanted are cut out of broad sheets of the metal. He speaks of the first hinges used by our forefathers. They were probably bits of vine, strong



Locks and hinges



Helen's house has a metal lock on its front door



Locks, latches, and keys can be bought at a hardware store

enough to tie the doors tight to the houses and yet let them swing open and shut. We remember Mary's tale of Patience True's log cabin. It had hinges of leather on both windows and doors.

Dick has found drawers filled with locks, keys, and bolts. Mr. Ford knows stories of strange locks of other times and far-away lands. He says locks have been used for thousands of years. In the days of the old Romans, before the birth of Christ, there were some locks so huge that their keys had to be held up with a prop before they could be turned in the great keyholes. Other locks were so tiny their keys could be mounted upon finger rings.

Among other metal fixtures for houses are closet hooks, curtain

rods, latches, and door-knobs. There are also metal spigots and faucets in our kitchens and bathrooms. Many small bits of metal are used in hundreds of ways in furnishing our houses. We buy a number of these things for the shelves of our Journey Club Museum.

Hardware is almost all made by machinery and so it is not costly.



A door latch

## CHAPTER 11

### METALS FOR OUR MUSEUM

"WHAT have you brought?" Mary cries as we come into the living room for the Journey Club meeting. We are to spend the afternoon in arranging an exhibit for our Museum. We have found out that there are several metals besides iron and steel, used in building our houses. These are copper, lead, tin, and zinc. Every member has some article made from one of these metals, and before putting them into their places upon the shelves, we are to write what we know about them on little white labels.

See what Jack has in his hand! It is a coil of shining wire. Its color is reddish. It is copper wire. Jack says that copper has been known for thousands of years. We can read about it in the Bible stories of times long before Christ was born. It is said

that copper was first discovered by the Greeks on the Island of Cyprus. The word copper comes from the name of that island.



Coil of copper wire

When the early settlers went west into the country around the Great Lakes, they found the Indians near Lake Superior using tools of beaten copper. In this way they learned that there were



copper beds there. To-day copper ore is mined in many lands, but the United States gives the world one half of all it uses. Arizona leads the rest of the states, but the metal from Montana is of a far better grade. Michigan and Utah have large copper mines, as do also several other states and Alaska.

Copper lies in beds down under the face of old Mother Earth. Like most other metals, it must be roasted and smelted to be taken out of its ore. Jack writes the label for the coil of wire. It reads: "Next to iron, copper is our most useful metal. Some things copper gives us are wire for telephones, telegraphs, trolley lines, and electric lights, door-knobs, fixtures, and spigots, metal sheets to cover our roofs, wash-boilers, tea-kettles, washing machines, and kitchen utensils. Mixed with zinc and tin, copper gives also brass and bronze."

As we tie on this label and place the wire on the shelves, Bob lays beside it a shiny new copper penny.



A copper penny

### Lead

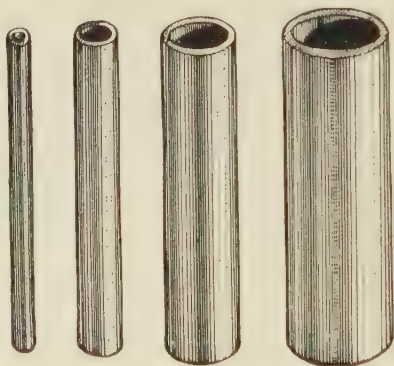
Mary's Uncle Fred is a plumber by trade. He has given her a piece of metal pipe for the Museum. It is dull gray in color. Mary says it is lead. She can scratch the lead with her finger nail, it is so soft. She asks Dick for his penknife. She cuts off a sliver from the side of the pipe. The fresh-cut metal shines almost like silver. Mary says it will turn dark before very long.

How heavy this bit of lead is!

One glass full of lead will weigh just as much as twelve other glasses filled with water.

It is because of this fact that we say a thing is "as heavy as lead" when we wish to explain that it weighs a great deal.

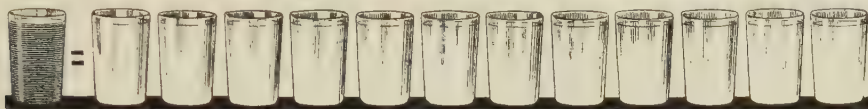
Lead lies in veins which run through the earth. It is found all over the world, but our own



Lead pipes

United States mines more than any other one country. Our Indians used lead before the days of Columbus. They roasted its ore

plumbing of our homes. Mary's uncle says that plumbers like lead pipe because it will not rust and crumble like iron.



One glass of lead is as heavy as twelve glasses of water

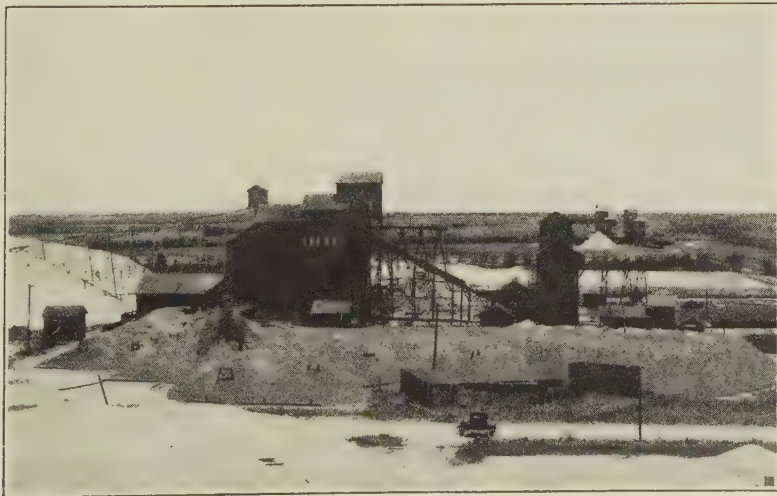
in ovens built in the hillsides. When later they traded with the "pale-faces" they often exchanged molds of this lead for the trinkets and beads they liked so well to wear.

At first lead was mined chiefly for making bullets and shot. It is still molded into these things to-day, but its better use is for the pipes and the joints in the

Among the things we write on our label for this bit of metal is this: "Lead is ground up in oil to make paint. In this form it covers the wood in millions of houses all over the world."

### Zinc

Edith has brought a square sheet of metal as thin as a piece of pasteboard. It is gray too, and



A zinc mine



A zinc mine, showing both surface and underground workings

it looks somewhat like the lead we have just handled. This metal is zinc. Our piece is a scrap which was left at Edith's house when a large sheet of zinc was trimmed to fit the wall behind her kitchen stove. Zinc is often used to protect woodwork from heat.

Dick runs his finger nail over this metal, but this does not make a mark. Zinc is harder than lead. But when it is heated, it grows soft and can be rolled out into thin sheets. In making the list of things for which we need it, Jack writes: "We need zinc for electric batteries, for lining tanks, for protecting our woodwork, and for the making of brass."

But Mary says that one of the best things zinc does for us is to make a waterproof coating for iron. Her Uncle Fred uses much iron pipe in his plumbing work. He says iron is given a bath in melted zinc to keep it from rusting. Iron coated with zinc is called galvanized iron.

Missouri is our zinc state.

Three fifths of all we have come from there. Its town of Joplin is in the very heart of the zinc mines. Joplin may truly be called "the City of Zinc."

### Tin

Helen is holding up a shining new cup. It glistens like silver. She asks us to guess what it is. We all shout, "Tin."

"And what else?" Helen cries.

We do not know what she means. We had always thought that a tin cup was



A tin cup

just tin. But Helen explains:

"No, it is iron coated with tin.

Iron and steel rust. They have to have a covering to keep out

the dampness. Tin, like

zinc, does not rust. But

it is not strong enough

to wear well by itself,

although it makes a fine

rain-coat for iron. Iron

coated with tin is called

tin plate. Most of the

tin we use comes in this

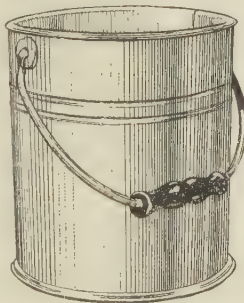
form. Its sheets may

be as thin as a leaf in a

book, or thick enough to make

a roof for a house. Tin is one of

the lightest of metals."

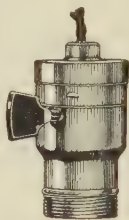


Tin is used for making pails



Our tin comes to us over the oceans. We have some beds of tin in our own country, but we buy all we use from other lands. The greater part of the tin of the world is mined in Southeastern Asia. South America, Australia, South Africa, and some sections of Great Britain also mine tin. Tin is found in ore, and in veins, nuggets, and dust. It must be heated many

times before its ingots are pure. The label we tie on the handle of Helen's cup says, "Tin is used for roofs, for spoutings, for the linings of bath tubs, and for making cups, pails, boxes, and kitchen utensils."



Electric light  
socket of brass

### Brass and Bronze

There are two other metals that we must add to our collection. These are brass and bronze. They are not found in Mother Earth's lap. They are made by mixing other metals together. Metals formed in this way are called alloys.

Dick has for us an electric light socket of shining yellow brass. We rub it with a bit of old flannel and it glistens like gold. Brass is a mixture of melted copper and zinc. It is harder than either one of these. Brass is molded to shape or rolled out in wire or in very thin sheets. We see it in beds, lamps, and many

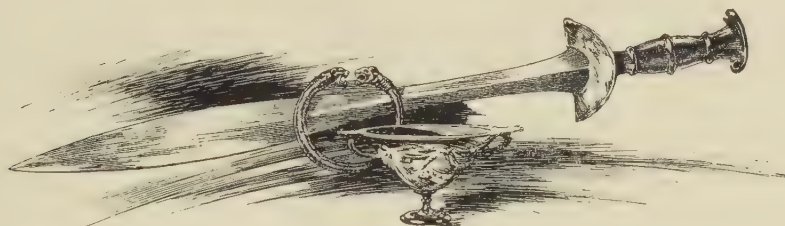


A bronze statue

everyday things. The biggest brass works in the world is in the western part of Connecticut.

Another alloy is bronze. Copper mixed with tin gives us this gleaming brown metal. Bronze is redder and darker than brass. It is hard and will last a long

time. We make from it ornaments for the outside and inside of our fine buildings. We cast it into statues, doorknobs, and door knockers. Before iron was discovered the best tools of the world were fashioned of bronze.



## CHAPTER 12

### THE WONDERS OF GLASS

"ONCE upon a time, long, long ago, a band of sailors landed on a sandy beach in Palestine. They first made fast their boat. Then

prop up these pots. So they used lumps of soda from the cargo in their boat. Higher and hotter they built up their fire, and they warmed themselves in its roaring blaze while they ate. Later when the fire began to die down one of the sailors noticed that the



How the first glass was made

lumps of soda had melted and mingled with the heated sand upon which they had been placed. Instead of the soda and sand were pools of a liquid as

they gathered pieces of driftwood with which they started their camp fire. Over its blaze they set up their pots and their kettles and began to cook dinner. They found they needed something to

clear as the purest spring water. This became hard as it cooled and turned into glass."

This is the tale of the finding of glass, as written by an old Roman story-teller. Our modern

glass-makers would say that a camp fire is not hot enough to melt sand and soda together, but glass was discovered so long ago that we cannot be sure just how it happened.



Glass beads

Glass has been in use for many thousand years. In the British Museum in London, on a shelf covered with dark cloth, there lies a tiny charm made of blue glass in the shape of a lion. On this little trinket is carved the name of an Egyptian king who lived 2400 years before Christ was born. So this wee bit of blue glass is over four thousand years old.

At first glass was made mostly for bottles and beads. It was hundreds of years before it was put into windows and doors such as we have in our homes to-day.

We should not like to do without glass in our everyday lives. We should have no tumblers to drink from, and we might have to go back to the horns and skin bottles from which our forefathers drank

in the days when glass was still rare. We should have no bottles nor jars to hold our food and drink and no mirrors to help us dress in the mornings. There would be no



Drinking horn

clear glass bulbs for our electric lights, no shades for our lanterns and lamps, and no eyeglasses nor spectacles to help dim eyes to see.

Worst of all, we should have no glass for our windows. Of course we might use paper like Taro in Japan, or shell like that which lets in the light in some Filipino houses.

Windows of clear ice serve our Eskimo cousins, but in our warmer climate, the ice would soon melt.



A glass bottle of early times

These friends of ours in other parts of the world cannot see out of their queer windows. Paper, shell, and ice will let some light in, but one cannot look through them. Helen says that windows should be the eyes of the house. Panes of clear glass like ours not only keep out the wind and the storm



and let in the sun, but allow us to see what is going on in the world round about us.

the Pullman, and are soon rolling over the rails toward the city of Pittsburgh. There we shall visit a factory where glass is made.



Helen says that windows should be the eyes of the house

#### A Trip to a Glass Factory

"All aboard," calls the conductor as he swings up on the steps of the last car of our train. We settle ourselves in our places in

The center of our glass-making is in Pennsylvania. The states which stand next are West Virginia, Ohio, Indiana, and New York. Kansas, New Jersey, and Illinois also give us some glass.

There are glass factories in many parts of our land. It was about one hundred and fifty years ago that the first glass-making works in the United States was built near Boston, Massachusetts. Most of its glass was molded into beads for trading with the Indians. Now we might visit a different glass works every day in the year, for the United States has nearly four hundred such factories. We sell much glass abroad, and we also buy a great deal from foreign lands.

At last our train pulls into the station at Pittsburgh, the chief glass city of the United States. Taxi-cabs take us out to the factory we are to visit. We soon find ourselves chatting with the manager whose name is Mr. Young. He tells us that he makes several kinds of glass here and asks us which we wish to see first. There is window glass, and plate glass, and glass made into articles by molding and pressing. We think window glass most important to us in finding out about the houses we live in, so we choose first to be shown how that is made.

As we stroll about the works, Mr. Young explains that glass is a certain kind of sand melted down with soda or lime and some other things. The sand must be pure. It is washed, roasted, and ground fine, before it is mixed with the other parts needed. Mr. Young says that often pieces of broken glass are put into the mixture to make it melt more quickly.

#### Where Window Panes Come From

Here we are at the furnaces. The ones we are watching are

tank-furnaces. The glass is melted in those huge tanks inside the ovens. Another kind of glass-making furnace has many clay pots to hold the glass mixture. These pots are set about a hot fire beneath a huge chimney.

How hot and noisy it is here! There is the sound of the machinery as the mixture is poured in to the tanks. There is the roar of the furnaces, and the cracking of glass. Mr. Young calls each tankful of glass mixture a batch. He shows us how the batch is put in at one end of the furnace as sand, soda, and lime, and how it comes out as clear molten glass. We peer into the furnaces, but draw back in haste because of the scorching heat. We can see the flames flowing over the tanks, licking the batch with their hot tongues, and turning it into a red seething mass. These fires are made with gas. They are often kept going for months at a stretch so that the furnaces shall never cool off.

Let us go over and watch that batch made into panes for our windows and doors. The tank of liquid glass is drawn to one end of the furnace. Look at that

man! He has a long iron pipe in his hand. He is a glass-blower. Now he is dipping the tip of his blowpipe into the melted glass.



A glass-blower

He twists it around and around in the mass until he has a blob of glass on its end that would weigh twenty pounds. See, he now raises the mouth of the pipe to his lips. His cheeks puff out as he blows. Slowly the glass swells into a mighty bubble. The blower waves the pipe around in the air. Then he blows again. Now he is swinging it far over his head. He knows how to give the bubble the shape it must have. Before our very eyes, the blob of glass takes the form of a gigantic pear.

Next our pear-shaped bubble

of glass is turned about on an iron slab and then placed inside the furnace to be heated again. Our eyes open wide as the blower takes it out and begins to puff once more at this giant glass bubble. Longer and longer it grows. Now it is almost as tall as the man himself. It has taken the shape of a cylinder, and soon the blowing is finished. As we gaze spellbound, Mr. Young says:

"Now watch! The glass-blower is putting his finger over the mouthpiece of his pipe. That will shut in the air. The heat will cause the air to become too great for its prison of glass. Listen and you will hear it burst forth."

Pop goes the cylinder! The air has cracked its end open. It is now easy to cut the rough edges smooth with a tool of cold iron. There is another cracking as the cylinder is taken off the blowpipe. For this a thread of cold iron wire is laid on the hot glass near the mouth of the pipe. This breaks the glass evenly with a loud hissing sound.

Our cylinder must next be cut open from one end to the other. This is done with a diamond

which is drawn in a straight line down the side of the great glass tube. We see the opened cylinder placed upon a table of clay. It is now run into a furnace and as the heat softens the glass it opens outward and spreads itself on the table in a flat sheet. We ask if it is now all ready for use.

"No, indeed," is the answer. "This sheet of glass must be smoothed and tempered. You

see, the glass in this sheet has been cooled very quickly, which makes it too brittle. It must be heated and cooled again little by little. So we send it on a journey through a long oven which is red-hot at one end and cold at the other. It takes a pane of glass several days to make the trip, but when it comes out, it is strong enough and tough enough to stand the hardest wear in your



Dick and Jack look at a finished window pane



windows and doors. This reheating and slow cooling is called annealing. Annealing is much like the tempering of steel."

Further on in the factory we see these sheets of glass cut into many sizes and shapes. Some of the panes are curved by cooling the warm glass on rounded pieces of metal. Our windows are not all the same size and some have more panes than others. Our guide tells us that many windows have four panes of glass in a wooden frame or sash.

Dick and Jack pick up one of the finished window panes. As we look at the flat piece of clear glass, we can hardly believe it was blown like a soap bubble from a mixture of sand, soda, and lime.

Mr. Young has also machines which will do the work of these human glass-blowers. Such machines are in use in many factories to-day, but some of our window glass is still blown as we have seen.

### Rolling Plate Glass

Our host shows us next the iron tables upon which plate glass is rolled. A noisy electric crane lifts a pot of melted glass and pours it out like so much fudge on the flat top of the table. Strips of iron keep the liquid glass from running over the sides.

These strips are just high enough to make the glass the right thickness.

Now an iron roller passes over the mass. The glass is rolled again and again. The table and roller are kept warm so that the glass will not cool too quickly. This plate glass must be re-heated or annealed just like its brother,

the window glass. It must be smoothed and polished and ground down until it is perfectly even.

We are interested in the making of wire-glass. We see that sheets of wire netting are laid on the plate glass while it is yet warm and soft. The wire sinks into the glass and as the mass hardens



Wire-glass

the wire is fixed in it. Wire-glass is so strong that it does not break easily like other glass. We have such wire-glass in the basement windows of our schoolhouse at home. We have also seen it used in elevators and other places where strong glass is wanted.

### Other Kinds of Glass

We spend several hours watching machines press hot glass into shape. The liquid is poured in iron molds and is pressed down by other pieces of iron worked by electricity. We see bottles and tumblers, dishes, and jars, all molded like this. There are some glass pans and bowls made especially for baking and roasting. Their glass is so treated that the heat of the oven will not cause them to break.

There is one department in this factory where cut glass is made. We find there pitchers and bowls and beautiful vases. These have been pressed

into shape and designs have been cut in their sides in such a way that they glisten and shine almost like jewels. The cutting is done by skilled workmen who hold the glass against whirring wheels of soft steel or sandstone. American cut glass is the finest of all. We could find it for sale in many far away lands.



How cut glass is made

We have luncheon at the factory with Mr. Young. As we eat he tells us wonderful things about glass. He brings out pieces of red, blue and green glass, and explains that certain metals put in the batches give these different colors. Helen



In a cut-glass factory

remembers the beautiful stained glass windows in her church at home. The small pieces of glass of which they are made are of many different hues. The bits are so fitted together that they form colored pictures and fancy designs.

Mr. Young speaks of Venice in Italy, where once was made the glass for all Europe. The secret of their glass was so precious to the Venetians that they kept their glass-workers prisoners on the island of Murano. They feared the workmen might let slip the recipe to some stranger from abroad. Once a glass-worker escaped and went to France. He told the secret and the Venetians later put him to death as a traitor. The secret is a secret no longer, for in almost every land now the people know how to make glass.

Paolo has visited the island of Murano. He says that each year

many travelers walk through the Street of the Glass-workers where much glass is still made. Murano is famed for its fine vases and its dishes of beautiful colors and shapes.

We hear of some glass which was spun into threads so fine they could be woven with silk into a dress. This was actually done for one of the world's great fairs. It makes us think that a slipper like Cinderella's might really be made. Bob has seen the collection of glass flowers at Harvard University. He says that one can count in the cases there more than eight hundred different flower sprays. They are so perfect it does not seem possible that they are not real. These glass flowers were made by a secret process invented by a German glass-worker. They were brought across the Atlantic ocean wrapped up in cotton.



## CHAPTER 13

### HOW WALL PAPER IS MADE

THE president of the Journey Club opens our meeting to-day with a question. As soon as all the members have come, he raps on the table and says:

"I am thinking of something we use in our houses that we get from the forests, and yet it is not wood. Who can guess what it is?" We look about and try to think of the answer.

"Is it thick?" Mary asks.

"No," Jack replies. "It is thinner than the nail on your finger."

Then Helen exclaims: "I know! It is wall paper."

"Right!" cries Jack. "Wall paper comes from the wood of forest trees ground to a pulp and pressed out into sheets."

It is hard to believe that the fine papers on the walls of our homes were once tall trees growing in the heart of the forests.

Our journey to-day will show us how this can be. We are to visit a paper mill and to find out what magic turns rough logs of wood into smooth rolls of paper.

Every day of our lives we use paper. It gives us our newspapers, our magazines, our books, all the boxes and bags in which come our clothing, our food, and our toys. At the soda fountains we sip cool drinks through paper straws. Every bottle the milkman sets on our doorsteps has a round paper cap to cork its wide mouth. The railway tickets for our Journey Club travels are thin strips of stamped paper, and the money we use to buy them may be paper greenbacks. In the wash room at school we dry our hands on paper towels, and every one of our lessons is written on paper. Even some furniture is





We inspect our wall paper [Jack, Dick, and Bob]

now woven of paper twisted to look like fiber or wicker.

But the paper in which we are most interested to-day is that for building our houses. Jack tells us that coarse heavy sheets coated with tar are put under the roof and over the framework of almost every house to help keep it warm. This is called roofing and building paper. Often thick paper board takes the place of lath and plaster

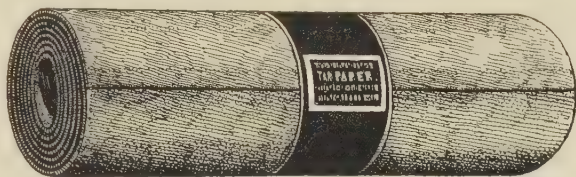
in the inner walls and ceilings of our rooms. But most important of all are the millions of miles of pretty wall papers which delight our eyes with their lovely designs.

Not so long ago — not more than one hundred and fifty years — there was almost no paper to be had in America. Our land was then still a part of Great Britain, and most of its wants were filled by the ships that sailed across the ocean from the mother country. Our forefathers were just beginning to manufacture things for themselves.

In those days paper was made of old rags ground to a pulp and rolled out into sheets. Every housewife was begged to save all

scraps of cloth and bits of old garments to send to the paper mills. It was in these times that a Massachusetts newspaper printed the following notice :

“The Bell-cart will go through Boston about the end of next



A roll of tar paper

month to collect rags for the paper mills.”

Below this was written a verse in praise of paper. It read :

“ Rags are as beauties which concealed  
lie  
But when in paper how they charm  
the eye !  
Pray, save your rags, new beauties to  
discover,  
For of paper truly every one's a lover.  
By pen and press, such knowledge is  
displayed  
As would not exist if paper were not  
made.”

Another newspaper stated it hoped every man would say to his wife, “Molly, make a rag-bag and hang it under the big shelf where the Bible lies.”

### The First Paper-Makers

The factories in those early American times were far different from the paper mills we visit today. We come by train and by motor cars to the door of a great brick building. As we sit in the Manager's office awaiting our



Wasps make paper-like nests

guide, we hear interesting things about paper-making.

"Look at this," says the Manager as he takes from a glass case a gray ball which hangs on the end of a stick. "This was made by the first paper-makers of all."

Here Edith breaks in, saying, "Why, it's only a wasp's nest."

"Yes," our host replies. "Hornets and wasps have known how to make paper much longer than man. They chew the fibers of wood and mix it with their spittle into a pulp. They spread it out thin, and they build it into these ball houses, layer on layer. As you walk through our mill, you will see that our paper is made just like this. Here machines take the place of the jaws of the insects in chewing the pulp."

"See that hole in the bottom of the nest," continues the Manager. "That is the door by which Mr. Wasp goes in and comes out. Inside his home are many small rooms or cells, all built of this paper." He peels off a sliver and shows us how thin is this silvery wasp-paper.

Our new friend shows us also pieces of old Egyptian papyrus, one of the first papers made by man's hand. He says it comes from the fibers of the papyrus reed. These are laid crosswise upon each other and pressed into sheets of a paper-like texture. All the ancient Egyptian writings were put on rolls or scrolls of papyrus. We are delighted to have a tiny

strip of papyrus for our Museum and also a scrap of creamy parchment made from the skin of a sheep or a goat. Bob thinks parchment looks like the ends of a drum.

A picture which hangs on the wall of the office shows paper-making in China. "The Chinese were the first people to make paper from wood," the Manager explains. "They used the fibers of their mulberry tree. Europe learned of paper from China, but

as mulberry trees were scarce there the Europeans used linen and cotton and then old rags instead. It is only within the last fifty years that paper began to be made here of wood pulp such as we use to-day. The best woods for making paper are the spruce and the poplar."

### A Trip Through the Paper Mill

This paper mill is built on the banks of a swift-flowing river. It is not far from great falls where the dropping water aids in turning the engines which run the ma-

chinery. A guide takes us to see the logs as they lie in the stream just outside the factory. In other

Journey Club trips we have found out how these logs are shipped out of the deep forests by train and by water.

Inside the mill we watch the whirring saws shave off the bark and cut the logs into sticks about two feet in length. Look at that moving belt! It is carrying an endless stream of these little wood sticks off to the

grinding rooms. We go along with it and soon see the wood flung into the mills. There great grindstones soon turn it into a powder. The wood is grated much like the nutmegs with which our mothers flavor puddings and cakes. The bottom of each grinding mill is half filled with water. The wood dust drops into the water and forms a soft pulp.

Here is a mill that has just stopped its grinding. A workman opens it up and we see that the bottom is filled with a gray mush. Mary sticks her finger in



The papyrus reed



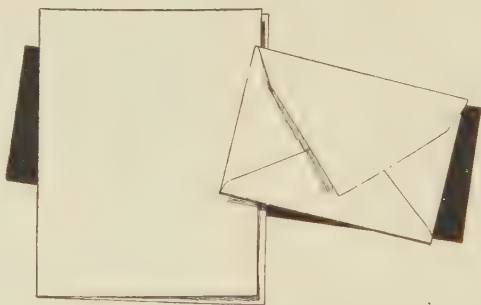
and brings out a lump. It looks like chewed paper. This mush is wood pulp.

Come, let us follow the pulp through the factory. We see it washed and strained, then thrown on a screen of fine wire netting over which flows running water. The water falls through the holes and the pulp spreads out on the top, coating the screen.

Our guide explains that paper is really fine wood fibers matted together like the fur fibers in a felt hat. He shows us how the coating is taken off the screen in broad sheets of pulp. We watch it as it is dried, bleached, and pressed. We think that the presses with their pairs of heavy steel rollers are like giant clothes wringers. Stand close to this pair and watch the stream of paper as it flows from between them! On, on, on it comes. As it runs out so quickly it is wound into a huge roll of the smoothest of paper, all ready to be made into a newspaper, a

book, or beautiful strips to paste on a wall.

There is now a newer and better way to make wood pulp. The logs are crushed or cut into chips and then thrown into acid which digests them just as our stomachs digest our lunches and dinners. The wood is cooked in this acid until the chips are a pulp no thicker than applesauce. This pulp is then dried and pressed out into paper.



Fine writing papers are made from rags

In the mill we are visiting a great many rags are also used to make paper. To-day, the rags do not come from the rag-bags in our homes. Nor are

they brought to the mill in a bell-cart. Instead, they are shipped here from all parts of the world, in car loads of firm bales. They must be sorted and all the buttons snipped off before the machines chop them to shreds. Other machines turn them into a pulp from which are made the finest of our writing papers.

### How Our Wall Papers Get Their Designs

We find that this mill does not make wall paper. So we visit another factory where the rolls of plain paper are given their patterns. We pass through huge rooms piled to the ceiling with rolls bought from mills such as the one we have just seen. Some of the paper has been colored in the making, but the most is white or tinted to cream.

Here a workman is starting a roll of paper on its long journey through the presses of the factory. We trace its path as it goes from one set of huge metal rollers to another. On each roller is carved a part of the design to be printed on it. Only one color can be stamped on the paper at one time. The first roller we

watch prints a design of pink flowers. By the next, green leaves are added, and a third puts upon it some dainty blue birds. Our paper goes so quickly from

one to another, that as we watch, it comes out all stamped with the finished design.

But the paper is not yet ready for use. It is too damp. It must hang on the drying racks until all the colors have set. Then it will be cut and rolled for the stores.

Do you know what we call the men who paste these wall papers upon our

rooms and halls? Paper-hangers! And that is queer because they do not hang the paper at all. The name comes from the olden days when people were just learning to cover their dull walls of stone and wood. The wall-coverings were

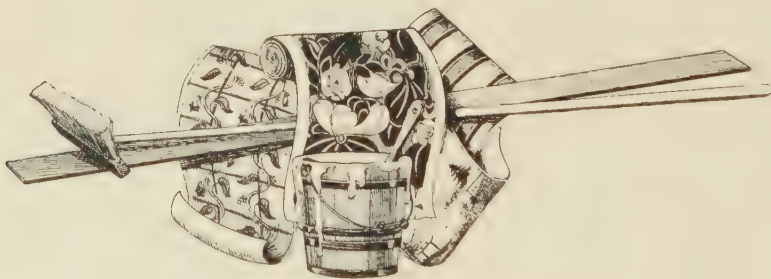


Tapestries were the first wall coverings

curtains of velvet, or leather, or beautiful hangings of hand-made cloth called tapestry. In these last, scenes and pictures were made with needle and yarns. Some tapestries covered a whole wall and many were as beautiful as a fine painting. The first wall papers imitated such wall hangings. They were called paper-hangings, and so came our name paper-hanger.

Many of the first wall papers were brought to Europe from China. Some were painted by

hand, and others were printed by means of small blocks of wood on which the designs had been cut. The invention of printing by the Chinese was the beginning of the machine-made papers we use to-day. But some of our finest papers are still printed with wood blocks. Each square of wood carries only one color. Block-printing is hand work and must be done with great care. It takes much longer than the great roller presses which turn out thousands of feet of finished paper each hour.



## CHAPTER 14

### THE PAINTER AND HIS HELPERS

WE are sitting in Dick's living room, waiting for the Journey Club meeting to begin. Suddenly the door opens and in march several of the Club members. Bob leads the procession. How funny he looks! He is dressed in overalls such as house painters wear. They are covered with daubs of paint of all colors. They belong to his older brother and are so much too big that he has had to pin them up with huge safety pins. On his head he wears a tight-fitting cap, and in one hand he carries a small bucket of paint. Several paint brushes stick out of his pocket.

He steps forth into our circle and speaks :

"I am the Painter," he says.

"I put smooth coats of paint on wood and on metal. I paint the walls of frame houses and of some brick houses too. I go over the window and door frames, the roofs and the chimneys. My paints cover the pipes and spoutings which lie out in the weather, and inside your homes my colors help make

your rooms bright and cheery.

"You could not get along without paint," this Painter continues. "You want it to make your houses look well, but more

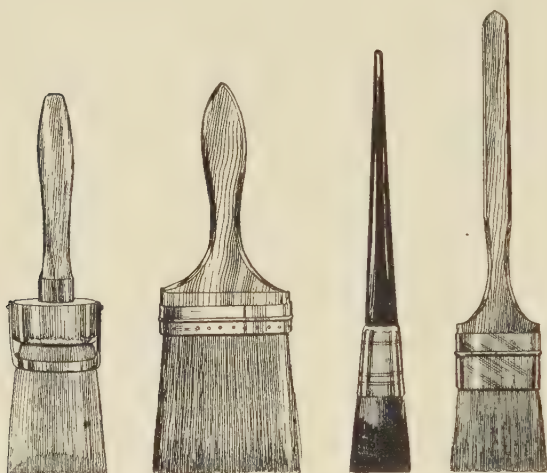


Bob dressed as painter



important than that, you need it to protect your woods and your

by a string. On the sign is pictured a giant can of green paint.



Paint brushes

metals from the sun and the wet. These will last much longer if they are kept snug and dry with raincoats of paint."

To show how this can be, Bob daubs a bit of paint on a small piece of wood. He asks for some water and pours a few drops on the spot he has painted. The water stands up in little round globes. It does not sink through the coating of paint.

### The Story of Paint

Bob next leads Mary into our circle. She wears a huge pasteboard sign hung round her neck

In each hand Mary carries strips of white paper on which are pasted tiny squares of every color in the rainbow. As she curtsies before us, the Painter says:

"This is Miss Paint. She is the greatest helper we painters have. On paint depend our work and our wages, so you may be sure we take good care of her. We try to have our paint as good as it can be made. But I will let Miss Paint tell her own story." The Painter steps back and Miss Paint begins:



Mary as Miss Paint

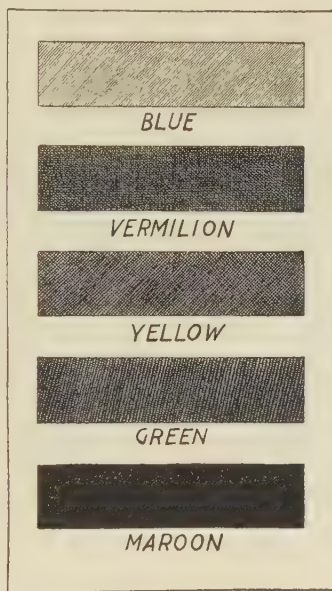
"I am one of the family of Paints. There are many kinds and colors of us, but we are all made the same way. Paints are not hard to understand. There are but two things in us. The first is a powder called pigment which gives us our strength and our color. The second is an oil with which the pigment is mixed. The oil turns the powdery pigment into a liquid so that the Painters can spread us out smooth with their brushes. The oil dries quickly in the air and leaves the paint firm enough to stand the rain and the wet.

"Our pigments come from many different things, although the most are made from minerals of one kind or other. The best of all is white lead. But there are also zinc white, and pigments from clay, copper, and iron. Black pigment comes from carbon, the sister of coal, or from the soot in the smoke of a fire which burns coke. This last is

called lampblack. Just let me show you how many colors we have."

Miss Paint unfolds her cards of paint samples. There are whites, blues, and greens, yellows, reds, browns, and blacks in their various shades. We pass them around while Miss Paint tells us more.

"Although paints have all of these different colors, you must know they are mostly made of white lead. A small portion of other pigment is added to it to give the color desired. White lead is the easiest pigment to mix with the drying



Miss Paint's cards

oils. No other has ever been found to do its work so well. You should see how white lead is made. Great sheets of metal are thrown into vats filled with acid somewhat like vinegar. The acid chews up the hard lead and makes it so that it can be ground into a powder. This powder, mixed with oil, gives most of your paints.

Almost every house in the United States has some paint upon it, so it has used white lead. Just think of the millions of homes which are better and stronger because of this metal."

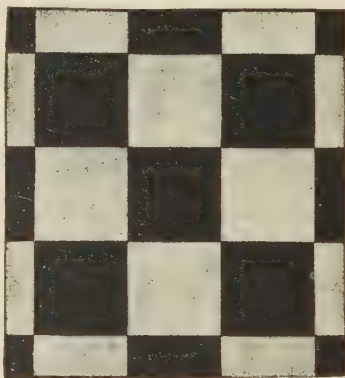
### Oils and Varnishes

As Miss Paint finishes her tale, the Painter leads forward another one of the Club members. This time it is Jack. He, like Mary, has a paste-board placard hanging from his neck. On his is a huge bottle marked Linseed Oil. Bob pats his shoulder as he introduces him to us.

"This is another of the Painter's good helpers. Both Miss Paint and I can tell you how much we need him. We could not do our work well if he did not aid."

"I am Linseed Oil," Jack explains. "I am pressed out of the seed of the very same flax plant from whose fibers comes linen. The seeds whence I sprang were first cleaned and ground up into a meal. This

was steamed and packed into bags of soft camel's hair cloth. The bags were then put into the presses. As the huge weights dropped down, the bags were squeezed again and again until every drop of oil was forced out of the meal. This oil was the Linseed Oil which I represent. I was filtered and boiled so that



Linoleum contains linseed oil

I should dry better when mixed with the pigments. Much linseed oil is used without boiling. Uncooked oil is called raw oil. It goes into the pigments just as it comes from the filters, and it makes good paints too. But oil for the very best

varnish and paint is sometimes cooked and refined again and again.

"I think I have a right to be proud of my family," Mr. Linseed Oil boasts. "You will find us everywhere. Not only in the paint in every room of your houses, but also in the linoleum and oilcloth in your kitchens and pantries. Mixed in printer's ink we help make newspapers and

books. These pages that tell of the Journey Club travels have some linseed oil in their printed words."

The last speaker of the day is Helen. She carries a bottle in her right hand. She takes out its cork and pours a few drops on her handkerchief. From the odor we know at once that this is turpentine. Here is the story Helen tells us:

"Once upon a time there was a forest of a certain kind of long-leaved pine trees. At just the right season, when the sap began to run up from the roots, men came with knives and made deep gashes in the bark. They placed a bucket beneath every cut to catch the drops of sap as they oozed slowly out. It would remind you of the tapping of maple trees in Vermont. The men returned later when the buckets were full. They emptied the thick molasses-like sap into kettles of iron, and placed these over a fire. You see the pure sap has in it turpentine and a kind of gum we call resin. As the kettles were boiled a thick steam arose, and was carried away into very cold pipes. When the steam touched the chill metal, it turned again to a liquid and

flowed out as pure turpentine. The gum, or resin, sank to the bottom of the kettles.

"That is the story of how I was made," says Helen as she speaks as Miss Turpentine. "I am used by the Painter to thin out his paints when they have become too thick to spread neatly. I am also put into varnish for woodwork and floors. Shall I tell you how varnish is made? Well, different gums or resins from the pine forests are melted to liquids, and mixed with linseed oil or another oil like it. When this mixture cools off, oil of turpentine is put in. So varnish is made. The varnish is strained through a cotton cloth, because to be good it must be perfectly clear. It is poured into tanks where it lies for six months. Then it is ready to cover your woodwork and floors."

At the end of our meeting, each speaker makes a present to the Journey Club Museum. The Painter gives a brush and a wee can of paint. Miss Paint leaves her cards of samples and colors, and Linseed Oil and Miss Turpentine give small bottles filled with the oils and varnish of which they have told.





Water is scarce on the Sahara, or Great Desert

## CHAPTER 15

### TWO LETTERS ABOUT WATER

Do you remember our Journey Club trip to see the tent homes in the Sahara, or Great Desert? We rode upon camels over the hot yellow sands, and we carried our drinking water in bottles of goat-skin. We did not waste a drop. When at last it was gone, we strained our eyes to discover an oasis at whose spring we could wet our dry throats. In recalling this trip, we think Lord Byron was right in this verse:

“Till taught by pain  
Men really know not what good water’s  
worth;  
If you had been in Turkey or in Spain;  
Or with a famish’d boat-crew had your  
berth,  
Or in the desert heard the camel’s bell,  
You’d wish yourself where Truth is —  
in a well.”

Water is necessary to every living thing. It sprouts the seeds

tucked away in the ground. It feeds growing plants and thirsty animals. And it gives food and drink to every man, woman, and child on this great round earth. Water is just as important to us as air and food. We must drink much of it if we are to be healthy. To find out how we get water from our lakes, rivers, and brooks, our springs, and our wells, is the next task we have set for our Journey Club. So we are to visit the water-works of our city.

Our President has a letter to read to the Club. It is from Edith, who cannot be with us to-day. She writes:

Dear Journey Club Members:

I am sorry I cannot go along with you on the trip to the water-works. I did want to see how



We get water from our lakes and rivers

the water is brought into the houses and stores there in the city. I should like to take some part in our meeting although I am not present. So I am going to tell you about our water here on the farm.

Mother remembers when the farmers had no running water at all in their houses or barns. She says that a few farmers do not yet have pumps and many do not have running water. She has a picture of the well they used when she was a girl. It was a great hole dug in the ground and neatly lined all the

way down with stone and brick. It was so big around that a man could climb down inside to clean it.

I asked mother how water gets into wells. She explained that the rain soaks into the earth. It goes down, down, down through the soil until it comes to a soft rock whose grains are so far apart that water can make its way through. This is called porous rock. Below the porous rock is often found a layer of other rock so hard that the water cannot soak into it. The hard rock stops the water and it lies in the

porous rock or in cracks, sometimes as big as caves, until some one digs down and makes a well from which it can be taken out. Sometimes the layer of soft rock runs through a hillside and at last breaks through the top of the ground. Then the water finds its way out and flows forth in a clear bubbling spring. We have springs in the hills back of our farm. Mother has given me a verse about such a spring. It says :

“ The Water, The Water,  
The gentle stream for me,  
That gushes from the old gray stone  
Beside the alder tree,  
I loved and looked on while a child  
In deepest wondering,  
And asked it whence it came and went  
And when its treasure would be spent.”

— *W. Motherwell*

Mother used to pull the water up from her well in a heavy wooden bucket like that in the poem, “The Old Oaken Bucket That Hangs in the Well.” Her



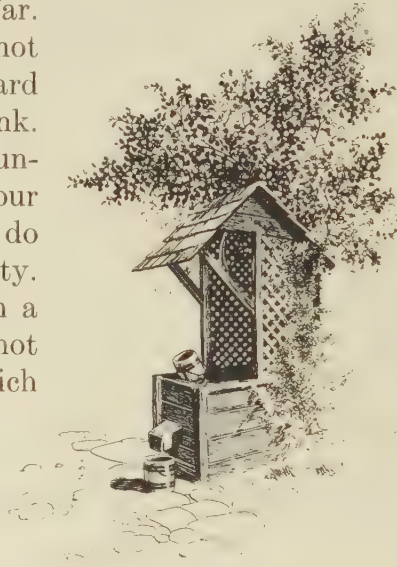
Many rivers give us water



arms often ached and her back grew very tired with carrying pails of water so far. | said they sometimes find water quite near the top, but often they

I am glad I do not have to work so hard for the water I drink. We now have running water in our house just as you do who live in the city. We get ours from a well, but it is not like that of which Mother told me. I remember when our well was put in. Men brought a drilling machine and bored

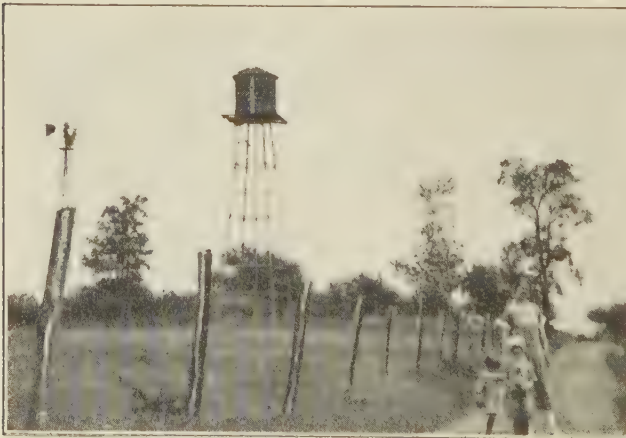
a small hole a few inches across, | the top of a steel tower, high in far down into the earth. They | the air where it will catch all the



An old-fashioned well

must drill down for thousands of feet. You should have been there when they struck water. It rushed up from the ground just like a fountain. Our well will give several gallons a minute. Its water is always as clear and cold as though kept on ice.

Our pump is worked by means of a windmill. The windmill is set on a tower like this are made of wood. As the wind turns the mill around and around, the wheel moves the pump. This forces the water up into a steel tank on another tower nearby. Such a tank is often placed in the steel framework just below a windmill. Water



Edith's windmill and water tank

will always run down hill, so Father put his tank high enough above our house and barn so that the water would flow down

stove and its boiler so that they give us all the hot water we need. When the wind does not turn the mill, Father uses a



Jacob's well in Palestine

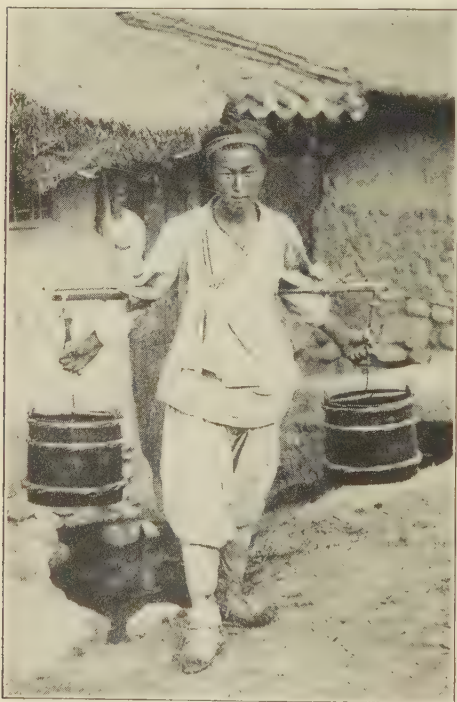
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through the pipes and out of the spigots in our kitchen and bathroom, and in the places for watering our stock. Some of the pipes are connected with our

small gasoline engine to pump the tank full.

We took great care in picking out the place for our well. Father says water soaks up whatever

comes near it and germs get in it quickly. He was especially careful not to put the well near a waste drain or the buildings where the animals are kept.



Korean water carrier

Here on the farm we use a great deal of water. Father, Mother, and I each drink about three pints a day. Then the farm animals must always have water where they can get at it. Even the chickens have their drinking bowls filled fresh every morning.

I wish you would write and tell me what you find out on your trip to the city water-works. I wonder if they are like ours.

With love to all, I am

Your friend,  
Edith.

#### Our Visit to the Water-Works

We too are sorry that Edith must miss our trip to the water-works of our city. As soon as we can, we answer her letter and tell her what we have seen. Our letter reads:

Dear Edith:

We want to thank you for your good letter, and also to write you of the interesting afternoon we had yesterday.

We rode on the street car out to the pumping station near the edge of the city. There we talked with the man in charge of our water supply. His name is Mr. Adams. He told us strange things about water in other parts of the world. He says in many lands the people work even harder for their water than your mother did when she was a girl.

In the poorer parts of Far Eastern Korea the water is carried



by hand from the streams into the houses. This work is done by boys who wear a wood frame-work or yoke over their shoulders. By it they can bring two pails at one time. There are no bathrooms. All the laundry must be done on the banks of the streams. It is the same in many parts of China and India, and in Manchuria, water is sold on the streets. The wells there are so dirty that all the water is boiled in giant teapots of brass. The steam comes out through a hole in the lid in such a way that it makes a shrill whistling noise. One can always tell by this whistle when the water-carrier comes. In Palestine goatskin water bags are still used, and in Egypt the girls walk about with tall water jars on their heads.

Mary thinks she prefers to turn the spigot and have the fresh water flow. Mr. Adams told us

that many men have worked hard so that we can do this. High above our city they have built great vats of stone called reservoirs. Our city reservoirs are so huge they will hold millions



In Palestine water is carried in goat skins

of gallons of water. Other men have laid pipes to the streams and springs up in the hills so that their water can flow down and fill up the reservoirs. Some cities take the water from rivers and lakes where these are near, and





Mary prefers to get fresh water from the spigot

others pump their water from wells drilled in the earth just like yours on the farm.

Here in our town we have two ways of getting our water from the reservoirs into our houses. We let it run down hill through the pipes, or we use the powerful machines in our pumping station. The machine pumps are run by electricity and steam. In case of a great fire, they can force out many times the amount of water we usually want.

All the water is filtered as it goes through the reservoirs. Mr. Adams says that water will make us sick if it is not pure and clean. So all our water is run through great filters of sand. These take up all bits of dirt and the water comes out pure. Sometimes a chemical is put in to kill the germs.

Rain is the purest of all water that hasn't been treated in

some way. A clear vapor rises from the face of the lakes and the oceans and is drawn up by the sun into the clouds. It falls again as rain upon the earth.



A modern bathroom

In many places rain water is caught as it runs down over the roofs of the houses. Perhaps you yourself have a rain barrel at the corner of your barn to hold the water that flows down through the spouting. Rain water

is particularly good for washing clothes.

We saw huge iron pipes running out from the pumping station. Mr. Adams calls them water mains. They are laid for miles under the widest streets of our city. From them smaller pipes branch out under the side streets. Still smaller ones bring the water into our houses. The city of Chicago has almost three thousand miles of such water pipes. If put end to end, they would stretch all the way from New York to the Pacific Ocean.

Bob asked Mr. Adams how

much water we use in one day. You will never guess what he said. It does not seem possible, but he says that here in the city we take from fifty to two hundred gallons apiece. Some people use much less and some use much more, and the factories need a great deal, of course. But it is hard to believe we could want so much, even with all our washing and bathing, and cooking and drinking.

We missed you yesterday, and we hope you can come to our next meeting.

Your friends,  
The Journey Club.



## CHAPTER 16

### THE THREE FAIRIES OF LIGHT

THREE fairies are beckoning to the Journey Club to-day. They are all fairies of light. Their names are Oil, Gas, and Electricity. They can drive darkness away and can make our homes almost as bright as can the Sun-fairy during the day. Their wonders are greater than all of the magic of the fairies who flit across the pages of story-books. But they are so much a part of our everyday lives that we seldom remember what marvels they are.

But indeed, it does seem like magic to think that the lights by which we read and play in the evenings come to us from down in the earth and out of the air. For years these fairies of light have been doing our bidding. We need only the flame of a match to get a bright light from oil or from gas. Aladdin's Slave of the

Lamp did not serve him so well as does Electricity, our Slave of the Button. It takes but the push of a finger on a wee button set in one of our walls to flood our room with electric light equal to hundreds of candles.

Let us shut our eyes for a moment and pretend we are living in the times of Patience True, back in the days when our country was still almost a wilderness. Our homes are log cabins where the only light comes from pine torches burned on flat stones in the fire-places. We do not dare light these torches out in the room because of their smoke which must go up the chimney. Like Abraham Lincoln, we often read lying down in front of the fire.

Patience True's father sometimes brought home whale oil which was burned in crude lamps



of pewter or tin. These were called Betty-lamps. Each had a wee bowl shaped like a pear with a nose at one end from which hung the cloth wick. The flame of the Betty-lamp was smoky and dull, and it filled the room with the smell of the whale oil.



A Betty-lamp

Later on Mrs. True learned to make candles, which were then the chief light of the people of Europe. There were but few stores in the new world of America, and the candles brought over from England cost a great deal. So every drop of beef fat or tallow left from cooking was saved until autumn when the candles were dipped. Mrs. True followed the advice of this old English verse :

“ Wife, make thine own candle ;  
Spare penny to handle,  
Provide for thy tallow ere  
frost cometh in,  
And make thine own candle ere win-  
ter begin.”

New England whale  
oil bracket

Patience helped melt the tallow in huge kettles which hung on the

at just the right distance apart to support two long poles laid down side by side. Across the poles were placed the rods of dipped candles as they came from the kettles. The candle rods were slender sticks from each of which hung six or eight cotton wicks. The wicks were often

thin twists of old rags. As Mrs. True dipped them into the kettle, each wick took on a coating of tallow. Slowly and with care she put them in again and again. They grew fatter and fatter with every dipping until at last they came out as finished white candles to help brighten up the long winter evenings. Patience

laid each rod of candles across the two poles to harden. She then handed her mother the next rod of wicks to be dipped.

Try as she might, a home can-

dle-dipper could not make more than two hundred candles a day. Mrs. True would be surprised if she could come back to life and walk through one of our modern candle factories. There any day she could see made a stream of candles which placed end to end would reach thirteen miles. Often as many as one hundred thousand candles are turned out in the working day of the plant.

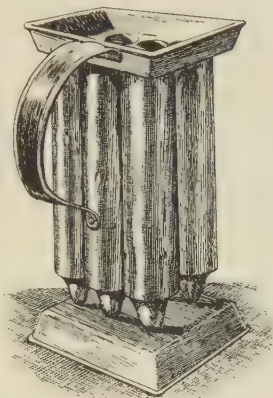
People soon learned how to make candles in other ways. Softened beeswax was pressed by hand into shape about thin braided wicks. But the quickest of all was to pour melted tallow into molds of pewter or tin. The wicks ran through the center of these molds and their ends were tied to candle rods much like those of Mrs. True.



Candle and candle stick

We ourselves have candles now and then in our homes, but they are for ornament rather than use.

We are especially fond of the green Christmas candles made from the wax fruit of the bayberry bush. We like to think that perhaps the promise of the old verse may come true for us.



A candle mold

"A bayberry candle  
Burned to the socket,  
Brings health to the body,  
Joy to the heart,  
And gold to the pocket."

Patience True had no matches. When her own fire went out, she often ran to borrow a live coal from the hearth of a neighbor. She knew also how to make fire without coal or matches. In those days every family had its own tinder box. In this were kept pieces of steel and flint and some dry bits of cloth or wood which would quickly take fire.



A tinder box

The cloth and the wood were called tinder. With the flint and the steel and a twist of her

wrist, Patience could strike a spark in such a way that it set fire to the tinder. She would hurry to fan this into a blaze. Patience often twisted bits of paper into long rolls called spills. By means of these a flame could be carried from one part of the house to another.

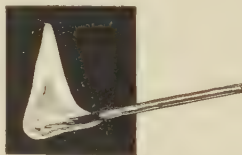
Most of the Journey Club members have never seen a tinder box. Our lights and our fires are started with matches which flow forth from factory machines by the hundreds of millions.

#### The Home of the Oil Fairy

Spills were used  
in place of  
matches

As we think of the discomforts of Patience True's home, we are glad that we live with our three fairies of light. We want to find out about the wonders they work and just how we make them serve us. If they were mere story-book fairies, they could per-

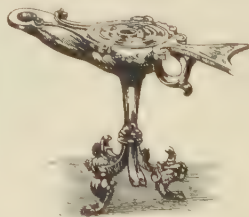
haps transport us from one place to another in the wink of an eye. But as their magic consists chiefly in giving us light, we shall depend upon our old friends the train and



Matches light quickly

the airplane to carry us hither and yon in making our journeys.

The oil fairy is the oldest of our three light givers. She has worked for us longer than either gas or electricity. Thousands of years before Christ was born, oils were used in crude lamps of stone, iron, and brass. But in those days there were no great oil wells and oils were scarce and expensive. Only the rich could



A Roman lamp

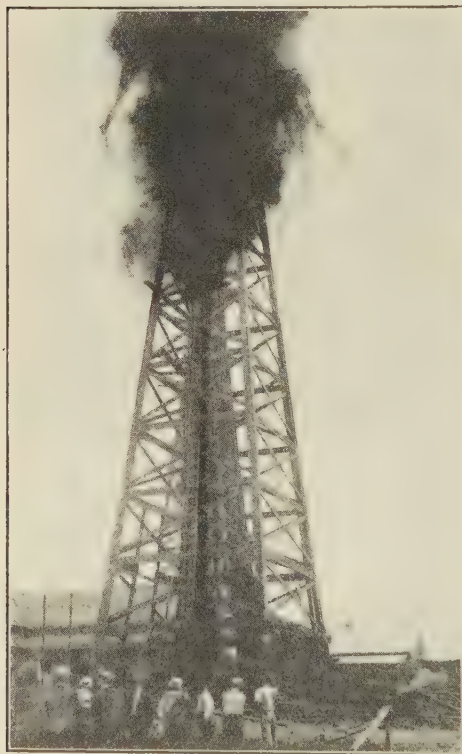
have lamps in their homes, and even theirs were as crude as the ones in Patience True's cabin.



A forest of oil towers



Little by little the lamps became better, but it was not until about two hundred years ago that the



An oil gusher

first lamp with a chimney was made.

When the white men came to America, they found the Indians gathering oil where it had bubbled up out of the earth and was floating on the waters of springs. The braves rubbed this oil on their bodies, thinking to make them-

selves strong. Now and then they burned it to light their weird devil-dances. But they were afraid of this "water that made fire" and thought it must come from some evil spirit.

Even the white men did not at first know how to make oil best serve them. They too gathered the oil, but they sold it in bottles as a cure for rheumatism. It was much later that our first oil wells were discovered in Pennsylvania and people began to burn oil as we do to-day.

Pennsylvania was once our greatest oil state. But her stores are now almost used up and we must turn to the newer oil fields in Oklahoma, California, Texas, Illinois, and Louisiana. These are the states which to-day give us the most. More than one half of all the oil of the world comes out of the ground here in our land. Russia's oil fields are nearly as large, but they are not so well worked.

We should need strong magic indeed to take us down into the heart of the earth from whence comes the oil we burn for light and heat. This oil is petroleum. Our oil fairy would tell us that

petroleum lies in beds in a soft, spongy rock. It waits there until the drilling machines bore holes through the earth and pierce the hard rock above which holds the oil tight in its underground prison.

See there! A drill is hard at work boring a new well. We start over to watch, when the men give a cry and come running toward us. They say the drillers have just struck oil. We must



The oil is stored in round red tanks

Let us take airplanes and fly to the oil lands of Oklahoma. We come to earth in a bare field close to where men are drilling. The ground nearby is covered with so many tall wooden towers that it looks like a forest. The towers are each built above an oil well.

keep at a safe distance. There is a roar and a hissing. A stream of black stuff rushes up from the well and gushes high in the air. Much oil runs out on the ground, before the men can force a steel cap over the mouth of the pipe to hold the flow back. The oil men tell us that sometimes a gusher



A train of oil cars

like this catches fire and burns for several days before it can be put out. Jack asks if all the wells are gushers.

"No," is the reply, "only a few. The oil has to be pumped from most of our wells. The greatest flow comes when we have drilled deep. You know, some wells show oil at a few hundred feet. Others must be dug down for hundreds and thousands."

Look at that oil flowing there on the ground! It is thick and dark. It does not seem at all like the clear kerosene we burn in our lamps, nor yet like the gasoline which helps run our automobiles. The men call this oil crude petroleum. They say it must be refined and made pure before we can use it. They point out the round red tanks in which it is stored.

One man shows us the beginning of the long pipe lines which carry this crude oil from here to the big cities where it is refined. These pipe lines run for hundreds of miles under the ground, just as our railway tracks wind their way over its top. Our guides say there are enough oil pipes in the United States to reach twice round the earth at its widest part. Every thirty miles there are storage tanks as big as a house and mighty steam pumps to help the oil streams on their trip from these wells to our homes.

On our way back from Oklahoma, we stop our airplanes near an oil refinery. Here we see how the petroleum is turned into kerosene, gasoline, and other oils we use every day. We find that the thick black crude oil is cooked until it gives off a pure vapor.



bringing in light and heat

The hot vapor runs into cold pipes where the chill turns it back into a liquid. It flows forth into the tanks as the purest of oils. Before the coming of gas, and before the invention of the automobile, kerosene was the most important of oils. It was used for light and for heat. To-day it must give place to gasoline. That is the oil of which we now use the most.

As we leave the refinery in our airplanes, we fly above long lines of tank freight cars, waiting for their cargoes of oil for shipment to our stores. Some of this oil will be put on tank steamers and taken across the oceans to far away lands.

### The Coming of Gas

Not much more than one hundred years ago, the streets of big cities like London and Paris were not at all well lighted at night. When one went out after supper, he carried his own oil lantern or torch. Watchmen walked the streets through the night and poked their long staffs into dark corners to be sure there were no robbers lurking about. The people trembled in their homes until they heard the cry of the watchman, telling and shouting, "All's



Watchman of old London

the hour well."

Our friend, the Gas fairy, brought a great change. She



soon began to take the place of her sister, the Oil fairy. Gas lamps along the streets turned night into day. And then came electricity which is even better than gas. To-day with both electricity and gas, we use but little oil for our lighting and heating.

Gas is better and cleaner than oil. Edith remembers when their light on the farm came from brass lamps in which they burned kerosene. They had to clean and trim these lamps every day. They filled them with oil, and clipped the cotton wicks smooth, and they washed the smoke and the soot from the glass chimneys. It took a good while, and both Edith and her mother were glad when they could put lamps away and use electric lights instead.

We have gas works here on the edge of our town. They are easy to find, for their great round red tanks rise high up in the sky. As we come near them, our noses tell us that we are on the right road. A strong smell of gas fills the air all about. As we walk

toward the brick buildings of the gas furnaces, we pass sheds filled with soft coal. Before our very eyes lies a pile big enough to keep five thousand families warm during next winter. Jack asks a workman why they have so much coal here. He replies:

"It is that coal which gives us the gas for lighting and cooking.

The coal is put into a tightly closed furnace called a retort. As the flames roast it, a gas rises and is caught in great pipes."

We walk with the workman inside the plant and see the coal blazing away in its box-shaped ovens. He shows us iron pipes as big around as Dick's waist. These

carry the gas off from the tops of the ovens. The workman picks up a piece of coal and also a bit of dark gray sponge-like stuff. This last he calls coke. He says coke is roasted coal from which the gas has been taken. The coke is burned over again under the furnaces to make their heat greater. It is also used in lamps for electric arc lights.



Modern oil lamp

Our guide tells us that the gas which rises from the blazing coal must be made pure before it goes into the storage tanks. So it is forced through pipes of water and is given a washing. The machines that take out its tar and other impurities are called scrubbers. The pure gas is stored in the round tanks we saw outside. From them it is brought into our houses by a system of pipes like those which give us our water.

By day and by night the Gas fairy waits at our beck and call. Helen has only to turn one of the keys on the front of her stove and touch off the lighted burner to have a steady flame ready for making candy or cake for a Journey Club meeting. In many places where electricity is hard to get, gas is still used for lighting. For most of us it serves chiefly for cooking and heating.

Sometimes we burn gas other than that which we get from



Helen cooks on a gas stove

roasting soft coal. There is a gas made from water which is cheaper than coal gas, and also acetylene gas which gives a strong bright light. In some places there are wells of natural gas. This gas comes from the earth all ready to be used for cooking, lighting, and heating.

### The Marvels of Electricity

We have now made journeys to the homes of two of our light fairies. We have come back from our travels and are resting at

tend that its shining bulb can tell its own story so that we may understand. If it could, this is what it would probably say :

"I am electricity! I am every-



Jack lights the electric lamp

Jack's house. We have still to find out about electricity, the youngest and most wonderful of our light-makers. It is growing late and Jack lights the electric lamp on the table. Let us pre-

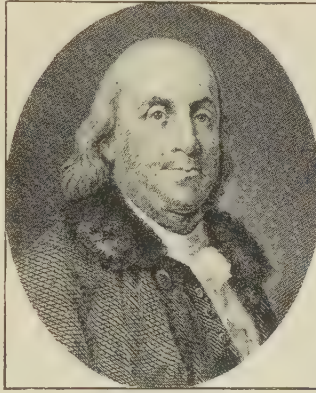
where. I am in the earth. I am in the clouds. I flash in the lightning and I run through the air. I make that crackling noise which you hear when you comb your hair on a cold frosty morning.

I have been in the world for thousands of years. But men did not know how to make me work for them until just a short while ago.

"Long, long ago; they began to suspect that I might be used. It is nearly one hundred years since Benjamin Franklin flew his kite in a thunder storm, trying to get me from the lightning by means of silk cord and a metal key. It is less than fifty years since our other inventor, Thomas Edison, finally learned how to harness me and

make me give light and heat. But I have made up for my lost time, for I now serve the people of every land on the globe.

"I am worked harder than ever you worked my sisters, oil and gas. I must turn the machinery of your factories. I must start, light, and help run millions of automobiles. I must move engines and street cars. Your telephones and telegraphs would not be except for me. Now comes a new task! For the radio I must send and catch

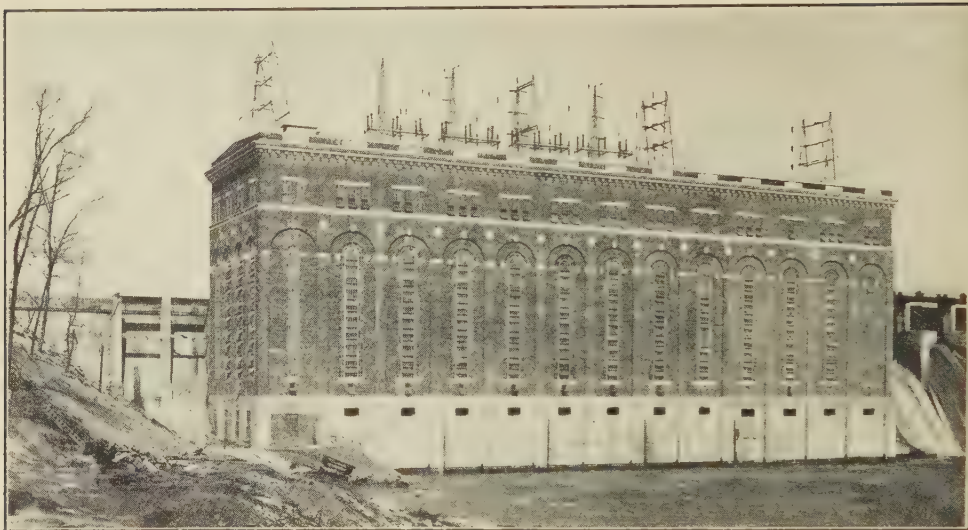


Benjamin Franklin



Electricity is in the lightning





An electric power house

sounds which travel thousands of miles.

“But the work I like best is to light up dark places. Each night of the year, I brighten the homes of millions of children. In almost every city of the United States there is a power house. Here electricity is made by machines called dynamos. These dynamos are magnets between which tight coils of copper wires are turned by steam or water power. As these fly round and round, they make electricity run out over the copper wire to other wires which carry it on to the houses and stores in the city. That town

is lucky which has a waterfall near it, for men have learned to turn their dynamos with waterfalls. One waterfall will often give enough electric power to light a whole city. If water power is not to be had, steam must be used to turn the dynamos.

“Look at my bulb! See that tiny thread twisted about inside the glass! That is carbon, the same material as coal and coke. I flow about through it and make it so hot that it grows white and gives out a dazzling light.

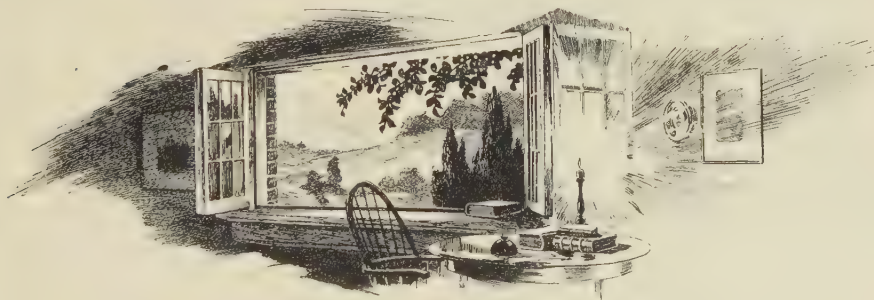
“You may think men know a great deal about electricity. But

I have still many secrets hidden from them. Each year more and more ways are found to use me. Who knows what I shall be doing for you fifty years hence?"

Before the close of our meeting, Jack takes us down to the cellar and shows us little boxes set in the walls. Their faces are covered with glass and inside them are meters which measure and show the amount of gas and electricity used in Jack's home.

Every bit of our light and heat must be paid for by our parents. If we are not careful to turn out our lights when we do not need them, our bills will be high. We should remember the old rhyme in which honest John Boldero tells how to keep down the high cost of candles. It also fits our own lights to-day.

"To make your candles last for aye,  
You boys and girls give ear-O.  
To put them out's the only way  
Says honest John Boldero."



## CHAPTER 17

### HOW WE KEEP WARM

WHEW! How cold it is!

We rub our numb hands and make straight for the fireplace to thaw out our red noses. It is



Savage making sparks with two sticks

the beginning of winter. Jack Frost lurks around every corner, nipping our ears with his chill biting breath. It is good to come from the out-of-doors into Helen's warm house. As we gather about her blazing log fire, we think of the poem "Snowbound" by John Greenleaf Whittier. In it he describes a New England family hugging their fireside during a blizzard. He says:

"Shut in from all the world without,  
We sat the clean-winged hearth about,  
Content to let the north wind roar,  
In baffled rage at pane and door."

Who made the first fire? We should all like to know, but we cannot because it was so long ago. The first men must have seen fire before they learned to use it for themselves. It might have come from lightning or burning gases. But it was a long time before



In the cold Northland

man ceased to be afraid of fire and learned to use it to warm his house, make his tools, and cook his food.

In our first Journey Club meeting we talked of the savage boy, Strong-as-a-Lion, who lived in a cave thousands and thousands of years before we were born. He wore the skins of wild animals to cover his body and his foods were berries and roots and the raw flesh of wild beasts. It may be that Strong-as-a-Lion's father was one of the first makers

of fire, and that it happened like this.

One day he found he could strike a bright spark by rubbing two sticks together. The spark fell on dry leaves and lo! a flame was kindled. We can imagine the wonder in Strong-as-a-Lion's eyes as he saw the beautiful fire, and we can almost see him grin as he spread out his hands before its warm blaze. Little by little his father found that twigs and branches would burn as well as dead leaves. Each chilly night



he would build a fire at the mouth of his cave-home and call his wife and his children to come and bask in the warmth of its hot glowing embers.

Many people thought that fire came first from the sun. The sun is the greatest heat giver of all. It has turned our part of



Outdoor fireplace and oven

the globe from a land of everlasting snow and ice into a garden of grass, trees, and flowers. At the equator, the earth's widest part, the earth is near the sun and the sun's rays fall directly down on the land. Its heat there is so great that it burns up the plants and unless there is much water, the ground is a desert. At the North and South Poles, the rays of the sun are slanting and long. They are so few that

they cannot melt the snow and the ice, and the land there is so cold that man cannot stay there. We are glad that our home is in one of the temperate zones where the heat of the sun is just right to make it pleasant to live in.

Among the stories of the old Greek gods is a tale of the bringing of fire down from heaven to earth, and in India there are people called Parsees who still worship the sun. The Parsees have in their temples fires which are always kept burning. They firmly believe these fires came direct from the sun.

The American Indian boy, Bald Eagle, would tell us that his grandfather

thought that fire was given to earth by the hoofs of a buffalo. He says the great beast was galloping over the plain when his hoof struck a rock and made a spark fly off on to some dead leaves, thus starting the first fire.

We may choose from these, the tale we like best, as none can be proved now. However, we may be sure that the savage peoples made fires in holes dug in the ground near their caves and

their tents. Later they built rude fireplaces of stone out in the open. They gradually learned that a chimney would carry off smoke into the air, and also would make their fire very much hotter. As our forefathers began to build better houses, they set up their fireplaces in the ends of their living rooms. Later they sometimes placed them in the center and built their homes around one central chimney.

There are many things about the life of boys and girls in those times which we should not like. But we should have enjoyed the long winter evenings when the whole family gathered about the log fires and told stories and played games in the warmth and light it gave out.

It was one of our greatest Americans, Benjamin Franklin, who first lined a fireplace with



Cooking on crude stoves made of clay

iron so that it would throw the heat out into the room. It was he also who invented one of our first practical stoves. Slowly,

the house. The heated air flows out into the rooms through small square iron gratings which Jack calls registers. Jack says the smoke

from the furnace goes away through a pipe that opens into the chimney.

Helen invites us to come down into her cellar. Her house is warmed with a hot-water plant. Her furnace is round. It is made of strong iron and is wrapped in a fireproof coat of asbestos to keep in the heat. Helen opens



A Mexican kitchen

year by year, other men have found better ways to get heat, until now we have the splendid systems of hot water and steam which keep us snug and warm in below zero weather.

### Heating Our Homes

Jack's house is heated by hot air. He says that a great pipe brings air in from outdoors and sends it over the blazing coals inside an iron furnace. The fresh air becomes hot and rises through pipes which wind their way over

the door and we see that the furnace is half full of coal, blazing away. She explains that a water boiler is attached to the furnace in such a way that the water is heated almost to boiling. She points out the pipes which carry the hot water from the furnace to the rooms in the rest of the house. As we go back to the living room she shows us the iron radiators into which the hot water flows as it comes up from below. The amount of heat which her hot water plant will provide depends



on the size of the radiators and the amount of coal burned.

Dick says his house is heated by steam. He thinks his furnace looks much like the one in Helen's cellar, but its boiler is such that steam instead of hot water flows through the pipes. His father is now burning petroleum in his furnace. He likes oil better than coal because it is cleaner and there are no ashes to be carted away. Natural gas is often used too in running such heating plants when there are gas wells in the neighborhood.

We are glad to get back to the bright, cheery fireplace. Its blaze would not give off enough heat to keep the house comfortable without a main heating plant, but we think there is no warmth so cosy as that of an open fire of bright blazing logs or red glowing coals.

As we plan to-day's trip, we think of the many countries where the children do not have warm homes like ours. Ikwa, our friend of Eskimo land, thaws out his fingers at a lamp of fish

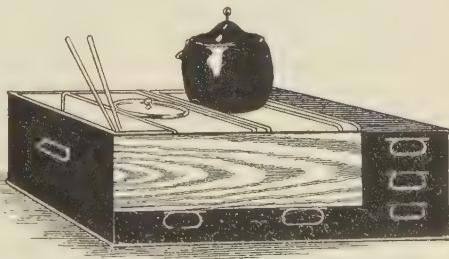
oil. Its heat often melts holes in the snow roof of his igloo, making wee chimneys which let out the smoke but also let in the cold.



A modern radiator

In our travels in China we have slept upon *kangs*. A kang is a ledge built at the side of the room. Pipes run beneath it and bring in the heat from the fire in the kitchen. Sometimes at night the flues grow too hot and one feels as if he were lying on top of a stove. Taro in Japan does not have much cold weather. His chief means of heating is by little fire boxes

in which he burns charcoal. He calls these *hibachis*. Taro's mother cooks the family meals upon several small stone hibachis in which charcoal is also the fuel.



A Japanese *hibachi*



### What Is Coal?

"I am as black as black can be  
And yet I shine.  
My home is deep within the earth  
In a dark mine.  
Ages ago I was buried there  
And yet I hold  
The sunshine and the heat which  
warmed  
That world of old.  
Though black and cold I seem to be  
Yet I can glow.  
Just put me on a blazing fire  
Then you will know."

Edith recites this verse and asks us to guess what is meant. It is too easy. We cry, "Coal," together. Coal is the chief fuel we burn to-day to keep ourselves warm. Wood is used in places where coal is not to be had or in fireplaces, and oil feeds more and more flames every year in our furnaces and factories. But coal is still our biggest heat-maker and most of us run our heating plants with it. To-day we are to journey down into a mine to see how this coal lies in the earth and how we get it out.

Let us take a small piece of wood and set it afire inside a bottle so tightly closed that air cannot get in. When the wood is all burned we find we have left

a bit of black charcoal. Charcoal is almost all carbon, which is about the same substance as coal. And coal was formed much like this charcoal we have just made.

Ages and ages ago, the world was covered with a jungle of giant plants and trees. Now and again, the waters of the oceans rose and flowed over the earth. The trees and plants rotted and fell to the ground and the waters laid over them a blanket of mud. After a time the waters lowered again and the earth rose above them. More trees and plants grew. Then again came the waters and smothered them under another blanket of silt. This happened time after time.

As the centuries went by, the blankets of mud hardened to rock and shut out the air from the trees and the plants lying between them. These same trees and plants were turned into coal by the heat from the earth and the pressure of the rock lying upon them. We can thus understand why coal is found in veins and layers between other layers of rock.

Sometimes coal is so near the surface of the earth that it can be



A drift in a coal mine

mined like a quarry or an open-pit iron mine. Other beds lie in the sides of the hills and can be reached by level tunnels called drifts. But the most of our coal is so deep underground that we must dig far down into the heart of old Mother Earth before we can reach it.

If we had but time to fly across the Atlantic Ocean to Ireland we should find many wet marshes filled with small trees and plants now turning to coal. They are already matted together with earth, and they need but to be dried to be ready for burning.

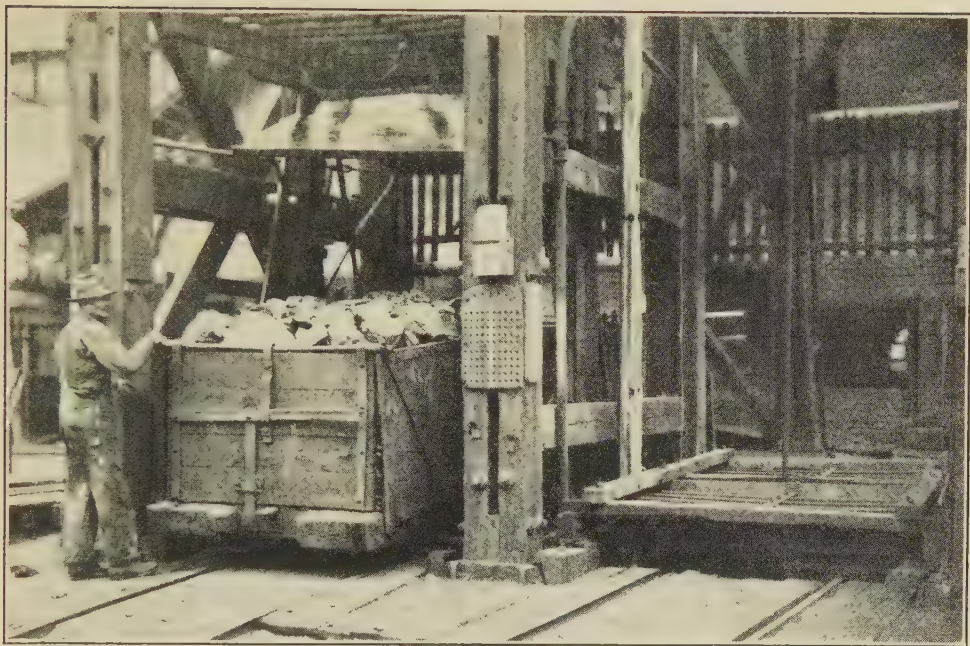
These marshes are peat bogs and the fuel they give is used by the poor people of Ireland for cooking their food and warming their houses. Peat is also used in places in Europe. We have beds of peat here in the United States, and we could find some also in Canada and other parts of the world.

Lignite belongs to the same fuel family. It is a soft brown coal which has not been lying so long underground as our hard and soft coal. In lignite beds are often found marks of the leaves and the tree trunks from which it has been made.



We walk around long trains of cars to get to the mine





Elevator shafts in a mine

### A Visit to a Coal Mine

To-day we are going to visit the coal mines of Pennsylvania. Our train takes us through other states where there are also many coal mines. West Virginia, Illinois and Kentucky, Indiana and Alabama all have huge beds of coal, but the most of that which we use to keep ourselves warm comes from Pennsylvania. This is anthracite, or hard coal. There are anthracite mines also in Colorado and New Mexico.

Our country takes more coal

out of the ground each year than any other land upon earth. And this is in spite of the fact that our first coal mine was opened up only a little more than one hundred years ago.

Railroad tracks run right up to the coal mine we are to visit. We pick our way over the rails and walk around long trains of freight cars to reach the mine offices. Here we ask permission to go down into the mine. The superintendent says he hopes we have on old clothes, for we are sure to



be smudged with coal dust on our trip. He tells one of the miners to go along with us and show us about.

We walk over to the elevator shaft. This is a big square hole

big enough to hold all of the Journey Club. Now we have started. Good-by, sunshine! Good-by, blue sky! We are dropping down, down into the dark. Our only light comes from



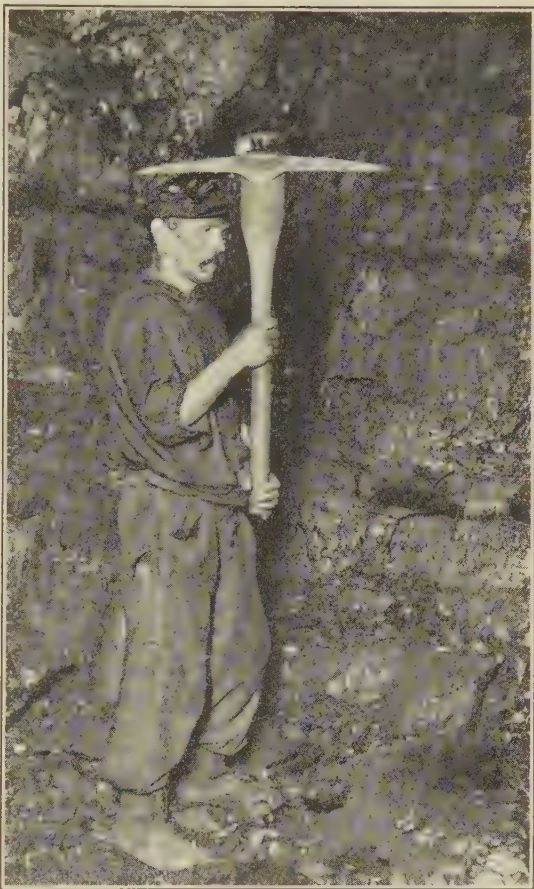
Each miner has a lamp in his cap

in the ground. We see that the shaft has several divisions. In two are elevators which the miners let down into the mine to bring the cars of coal up to the surface. Through other parts of the shaft fresh air can be pumped down to the men who are at work so far under the ground.

"Watch your step!" calls our guide as we enter the elevator. We are in a little iron cage just

the little lamps which we have been given to light us on our way. Every miner wears such a lamp hooked on the front of his cap. In this way he has light and still has his two hands free to work. The tiny flames burn inside metal shields. There is a dangerous gas all through the mine which might explode if it should touch flame. This gas is called "fire damp," and all miners fear it.

Now our cage stops. We step out into a dark tunnel and strain our eyes into the blackness. Here and there in the distance we see the flicker of a miner's lamp moving about like a firefly. Soon we make out that the walls of our tunnel have been chiseled from a bed of solid black coal. We walk down through the tunnel. It is broad enough for us to stand five abreast. We pick our way carefully so as not to trip over the railway tracks which run under our feet. We pass many other tunnels running off to the sides of the main shaft, and now and again we peer into yawning caves of pitch blackness. It seems to us that the mine is like an underground hotel, with many long halls from which open the rooms. We notice huge posts of coal which have been left all along the shaft. Our guide tells us these help hold up the earth above. Heavy wood and steel beams serve also as props. Now and then the roof of a tunnel or chamber falls in. Sometimes it



Miners make first holes with hand picks

imprisons the men working in it. If they are not dug out at once, they may lose their lives.

By the light of our lamps we see just how these black walls are cut out of the earth. We watch the miners make the first holes with hand picks, and listen to the

boring of the machine drills as they bite their way into the hard coal. These drills make pockets to hold the powder and dynamite which blast down the walls.

Boom! Boom! Boom! A charge has just gone off at the end of that tunnel. The whole mine seems to shake, and our ears ring with the noise of the explosion. When our guide says it is safe, we hurry over and peer at the hole it has made. Miners are already at work loading the black chunks on a train of tiny cars. When these are full, they are hauled by an electric engine over the tracks out to the shaft. The miners tell us that mules once pulled all the coal from one part of the mine to the other and that in many places the poor beasts still do this work to-day. We follow the path of the full cars of coal, and ride up in the next cage to the mouth of the shaft.

How pleasant it is to step out into the sunshine again! We fill our lungs with the cold crisp air, and we wonder how the miners can bear to spend their lives underground in the dark. We feel grateful for the hard work

they are doing to help keep us warm.

Our guide next shows us how the coal is hoisted up to the top of a building near-by. In this is housed a machine called a "breaker." The iron jaws of its rollers crunch the huge chunks into pieces of the right size to be sold in the coal yards. We stand by giant troughs or chutes through which a steady stream of black coal clatters down from the breaker.

Look at those men and boys standing by the chutes! They are picking out bits of rock and slate as the broken coal rattles past. Our guide calls them "breaker-boys." It is seldom that they let pass even a very small stone.

Our broken-up coal is next run over screens or sieves which have holes of many sizes. The wee bits fall through the small screen, the next largest are dropped through a second, and so it goes on until all the coal has been sorted. It is now ready for shipment by train or by water to the coal yards of our town. The slow-moving boats which carry coal over the water are called





Breaker-boys pick the rocks out of the coal

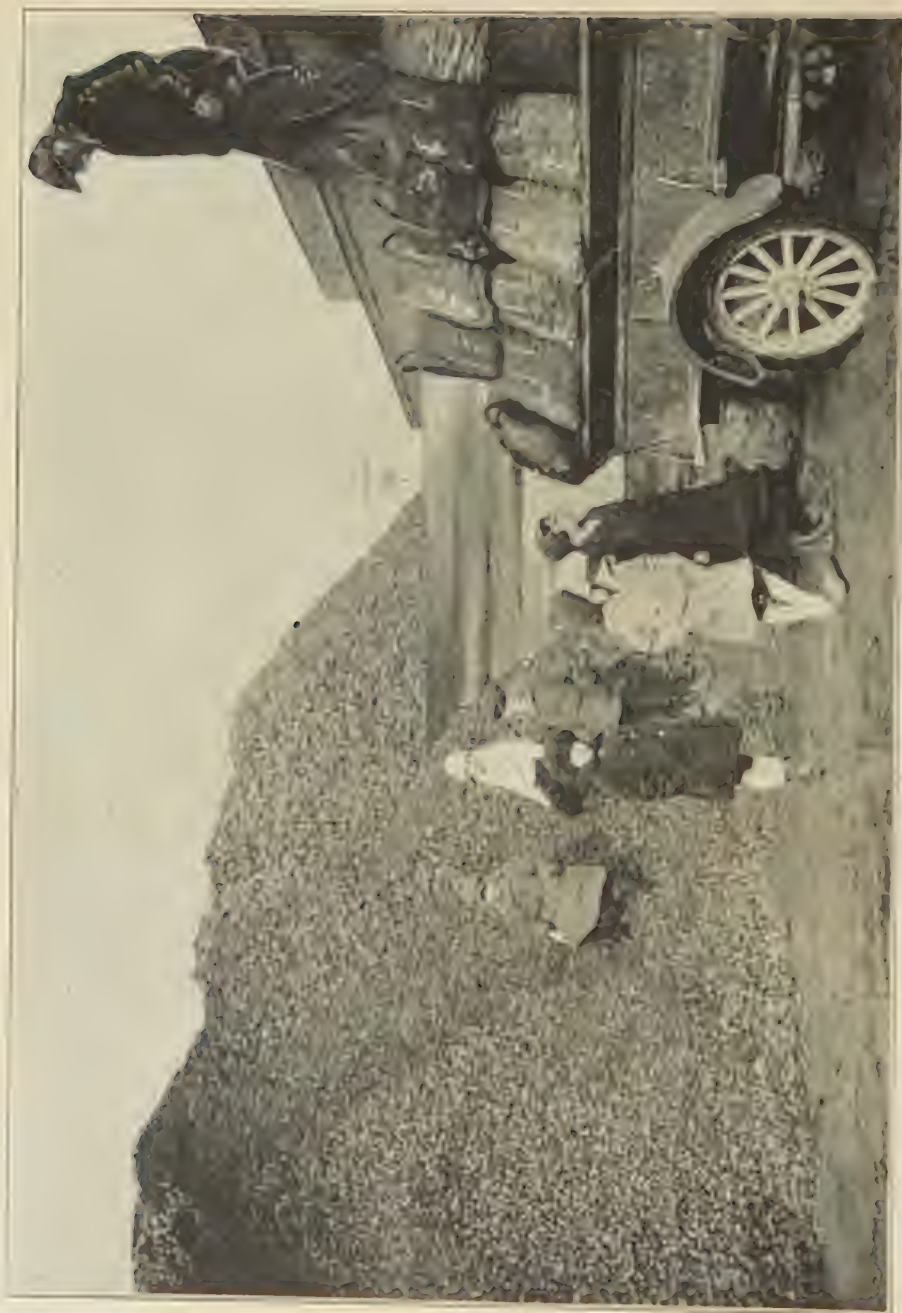
barges. They are usually pulled along one after the other by a puffing steam tug-boat.

We find that when we order coal and say we want furnace, egg, stove, nut, or pea coal, we are not speaking of separate kinds of coal. The names refer to the sizes of the lumps. All anthracite is of much the same grade, although it sometimes is named from the coal region it came from.

As we stop at the office to thank the superintendent, Edith asks him the difference between hard and soft coal.

"Hard coal is called anthracite," says he. "It is firm and solid. It is found farther down in the ground than other coal, and it burns with a small flame and almost no smoke. It throws off a great heat. It is the very best coal for heating your houses

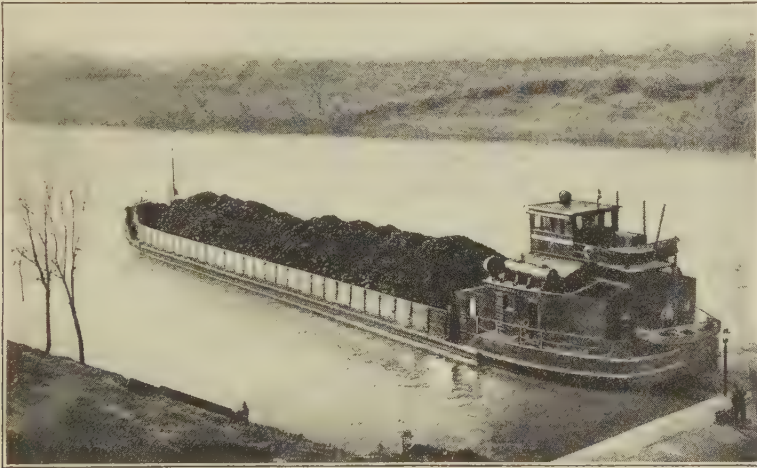




We visit a coal yard

Now soft coal has a different name. It is bituminous coal. Its flame is brighter and it gives off much smoke. It does not produce nearly so much heat as our friend anthracite. Soft coal is used chiefly for factories, railways, and steamships. Its smoke

many factories run by this fuel, and then Mary speaks of the dreadful coal strike of some time ago. We can see how important is the work of our good friends down in the mines, and we do not wonder that coal has been called Black Diamonds. Coal is made



'A coal barge

darkens the air, and its sticky black soot discolors the buildings in places where it is burned. A ton of soft coal often brings but half as much money at the mines as a ton of good anthracite."

As we travel home, Jack reminds us that coal is making the steam for the engine which is pulling our train. We talk of the

of carbon. So is the diamond. The diamond has great money value, but coal is far more precious to us. We can live without jewels, but we must have heat to warm us in winter, and we must have steam to turn the machinery that makes for us much of the foods we eat, the clothes we wear, and many of the houses we live in.

## CHAPTER 18

### A FURNITURE TALK

POOR Dick! A few days ago he hurt his foot badly while playing football, and he is not yet allowed to put it on the floor. He must sit in his big chair and keep his sore ankle propped up on a stool. He has been amusing himself with his father's radio set. It is still working and gay music greets us as we enter his house. Soon every one has arrived. It is time to begin, so Dick turns off the radio and Jack opens the meeting. He says:

"To-day we are going to find out about furniture. In our Journey Club travels, we have seen many strange homes. Do you remember how we slept on the floor in Japan? And how we ate our meals from tiny tables not eight inches high? We have rested on kangas, those ledges which serve as beds in the poorer

houses of China, and in better homes in that land we have found bedrooms with furniture much like our own. In the Far East we learned to eat our rice with chopsticks, and in Korea and India our only dishes were bowls of bright shiny brass. We found the children in Europe living much as we do. But in all of our travels we have seen no homes so comfortably furnished as those in our own land."

"None of us wants to take a trip without Dick," Jack is still speaking, "so we have thought of a way to find out about our furniture without leaving Dick's house. As we came in to-day, we heard this radio pouring out music which was played many miles from our town. This afternoon we are to have a radio talk even more wonderful than this.

Mary and Bob will broadcast for us the voices of things we have never heard speak. We need only to use our imaginations and we shall listen to the stories of the very tables and chairs here in this room. We shall find out how and where they were made, just as if they were really telling us their stories themselves."

Jack moves Dick's radio carefully into the center of the room. Mary and Bob take their places behind the table on which it stands. They are almost hidden from view. It is not hard for us to pretend with them that their voices are coming out of the radio cabinet. Mary speaks first.

#### The Tale of the Grandfather's Clock

"This is station M-A-R-Y broadcasting a furniture talk for the Journey Club members. The speaker is an old friend of ours. He is the Grandfather's Clock which stands in the hall. Sh-h-h! He is ready to begin.

"Tick-Tock! Tick-Tock!

Listen to me, the Grandfather Clock! I am old, old, old. For more than one hundred years I have been ticking away in one hall or another. I have seen many homes and furniture of many kinds. Back in the days when I first began to tell time, the tables and chairs, the beds and

the clocks were all made by hand, and only one at a time. The carpenters and cabinetmakers took great pains with us. They cut our wood with hand tools. They fitted our tiny pieces together with their own fingers. They carved us and polished us so that we should have beauty as well as strength. They made us so well that we will last for hundreds of years.

"There are many tables and chairs quite as old as I still in use to-day. And I am glad to inform you that the furniture from



A Grandfather's clock

the homes of your great-grandfathers is becoming stylish once more. Some of us old fellows even bring higher prices than new pieces fresh from the up-to-date factories.





At a Journey Club meeting [Helen, Edith, Bob, Mary, Jack, and Dick]

"I wish I could tell you all the tales I have heard of the queer ways of people who lived long ago.

It is said that the first savages slept on beds of leaves, twigs, and grass.

Their tables were only flat pieces of stone. It has taken thousands of years for men to learn to live as you Journey Club members are living to-day.

You are far better off with all your comforts than

were the kings and emperors of Bible times. Their chairs were often trimmed with silver and gold and sometimes were even studded with jewels. But their couches were hard, and they had none of the wonderful gifts of gas and electricity.

"When the Pilgrim Fathers landed on Plymouth Rock, most people in England were using a folding board as a dining table. It was brought out for each meal and set up on supports.

The tablecloth was the "board cloth" and from it also comes the saying "Gather around the fes-

tive board." There was but little china in those days and so few knives and forks that the children,



Old-fashioned tables and chairs are stylish now

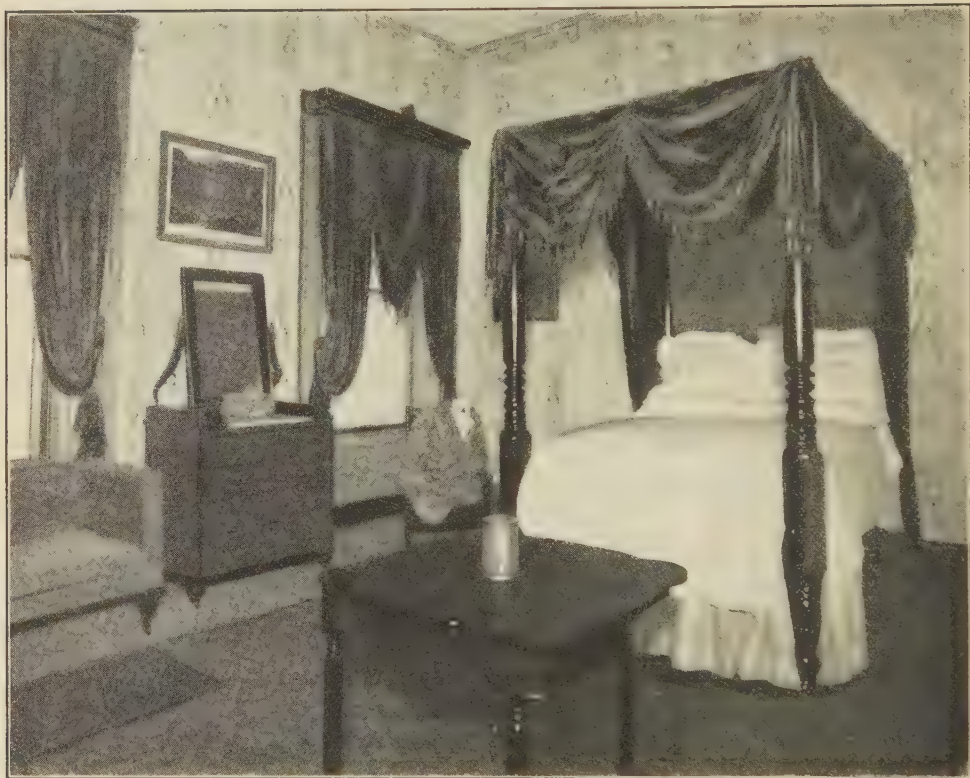
and grown-ups too, ate with their fingers. Often there were but one or two chairs in the whole house. These were kept for the older people or for visiting friends.

"How would you like to have no chairs to sit upon, and no china dishes? Children in the early days in America squatted on wood benches or stools with three legs, and ate from wooden plates. My first home in America was a roomy Colonial house in the time of George Washington. You should



Our forefathers had little silverware

have seen the beds they used then! At each of the four corners was a tall post, and above



A four-posted bed

was often a roof or drapery of cloth. Some of these four-posted beds had side curtains which were closed tight every night. I wondered how the sleepers could breathe, but the people then did not know how to value fresh air. And how cold it was in that house! There were no stoves, and the pitchers of water often froze in the bedrooms. Even the poorest child you know to-day

is more comfortable than the girls and boys who lived then."

So ends Mary's tale of the Grandfather's Clock. Jack pretends to twist the dials on the face of Dick's radio. Then comes Bob's voice.

#### Furniture of To-day

"You are now listening to Station B-O-B. Mr. Easy Chair



will recite for you some of his adventures on his recent trip through a modern furniture factory in the city of Grand Rapids, Michigan. As you probably know, the greatest furniture centers of the whole world are New York and Chicago. But Grand Rapids has also hundreds of factories and it is still often called "The Furniture City." But I will let Mr. Chair tell you his story himself.

"Unlike the Grandfather Clock, I am not old. I am young and so newly made that I can still remember the forest from which I came. This wood frame of mine was part of a walnut tree not long ago. I came to the furniture factory in a shipment of boards from the lumber mill. I was piled by the sides of woods from all over the globe. I rubbed ends with mahogany and



Jack and Bob are sitting in chairs made at Grand Rapids



Good furniture should be simple

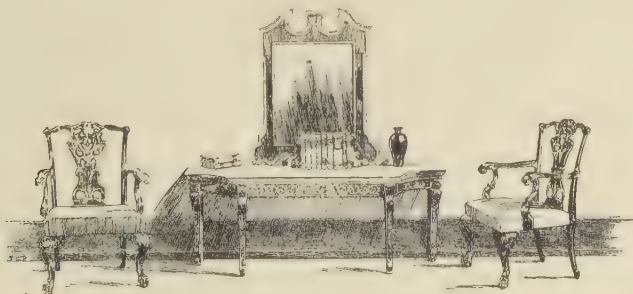


rosewood from far-away forests in South America and Africa. I made friends also with cherry, oak, and bird's eye maple, from the United States.

"How my head buzzed as I went through the machines. Some cut me. Some sawed me. Others planed my wood smooth. I was shaped after a pattern, and my separate pieces were fitted together with care. There were many more chairs exactly like me being made at the same time. Our springs were set in our seats, and soft paddings were put on our arms and our backs. Then came our fine outer dresses of cloth and our cushions of down. Machines were used on us. Perhaps we are not made to last for hundreds of years, but every care was taken to send us out strong and firm and fit for hard wear.

"I came from that factory in the midst of a stream of furniture of all kinds. There were tables and chairs for every room in a house. There were bureaus and cupboards, desks, stools, and chests, and bookcases and beds. My factory puts samples of its finished wares in the furniture fairs. Every great furniture city has special buildings where these fairs are held. The furniture-makers send in their goods and the store-keepers come from all parts of the land to look them well over before giving their orders. It was at such a furniture fair that I was ordered by the store where Dick's father bought me.

"Choosing furniture is a difficult task. It is the furnishings that turn a house into a home. All of you want nice things about you, but you will do best when you select those which are simple and good."



## CHAPTER 19

### IN THE LAND OF THE MAGIC CARPET

SINCE our last Journey Club meeting we have traveled thousands of miles. We have come across land and sea to Persia, the home of the beautiful Oriental rug. We want to find out about the coverings for the floors of our houses, and we shall begin our adventures here in the land which has long given us our finest and best.

It is a long jump from the skin rugs of the cave-man to the soft carpets upon which we walk to-day. We do not know who made the first woven carpet, but ancient stone carvings show pictures of rugs which were used in Egypt and in the Far East thousands of years ago. Rugs were then so costly that only kings and the very rich could afford them. In olden times, rugs were often spread in front of the temple altars to honor

the gods whom the people then worshiped.

As we walk through the streets of the Persian city to which we have journeyed, we see many queer sights. Everywhere are dark-skinned people dressed in strange baggy clothes. We have the address of a famous rug-maker, and at last we find our way to the gate of his home. We knock. An eye looks out through a peep-hole cut in the wall. When we tell who we are the door swings wide open, and we are led through a courtyard into the house. As we enter, we are asked to take off our shoes and put on soft slippers. The floors are covered with handsome Oriental rugs. They are so fine that we do not wonder our host objects to our treading upon them in stiff leather soles.

This man is one of a family of weavers. Most of the Oriental rugs are made in the homes of the people, and the secrets of their weaving have been handed down from father to son for hundreds of years. Some of the very rugs upon which we are walking were woven before Columbus discovered America. Our Persian host tells us that he has taught his daughter Fadi to weave rugs, and that she will show us how it is done. He says that the Oriental rugs of to-day are made in about the same way as those of long, long ago.

Our new friend claps his hands



Fadi, the rug-weaver



Girl wool-spinner of Persia

twice. The curtains at the door part and in walks Fadi. She is a girl of about our own age. She has on full blue trousers, and her blouse is covered with gold and silver embroidery. Her black eyes dance when she sees the Journey Club members. A broad smile brightens her dusky face. She is delighted to show her skill.



Fadi leads us into the room where her loom is set up. This has two upright posts which hold a rough wooden frame. It is just the size of the rug she is making. She points out the long threads of the warp which are stretched up and down over the frame. These threads must be strong.

The Persian girl works on the back of the rug. We peer around to see the right side and there find a beautiful design in soft reds, blues, and yellows, fast growing out of these wools which she knots so neatly in place. It seems like magic to us. It is almost more wonderful than the real Magic



Woman weaving on a hand loom

They are of hemp, cotton, or wool, and sometimes of silk. The ones before us are of hemp. Fadi now squats before the frame and begins to tie tufts of wool yarn. These tufts are of many colors. She knots each one to the warp threads. We ask her how she can tell which colors to use, and she replies that she knows the pattern by heart.

Carpet of the Arabian Nights tale. Do you know the story of how it flew through the air at the will of the person sitting upon it?

See! Fadi has finished knotting a whole row of tufts. Now she is weaving a woollen thread over and under the threads of the warp, and just above the last row of tufts. She takes a blunt comb

and forces this woven thread down on the tufts, pushing them both tight upon that part of the rug which she has already woven. When the weaving is all done, the tufts on the right side will be sheared to even lengths and the rug will take on the look of the smoothest of velvet.

Fadi says that she has made a number of rugs. But the work

always goes slowly. It will take her several months to finish this one. Her father tells of a carpet which was twenty years in the making. He says the value of rugs depends on their beautiful designs and the closeness of the weaving. This can be seen by the number of knots or tufts tied in a square inch. Some rugs may have less than two hundred, and



Each tiny figure in an Oriental rug has a meaning

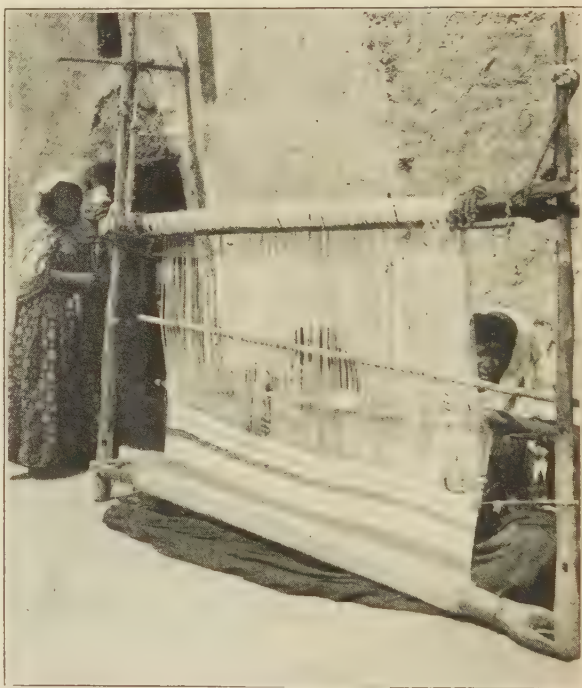
others as many as seven hundred and fifty. The more knots there are, the finer the rug.

The rugs we see here in Persia are beautiful. Their colors are soft. The dyeing is important, and many rug-weaving families make their own dyes and keep them also a secret. The vegetable colors of olden days last longer than do those newer ones made from coal. We call these coal tar colors aniline dyes.

Oriental rugs are of all sizes and patterns. Some have stories in their designs, and each tiny figure may have its own meaning. We like the prayer rugs. They are little mats just big enough for a man to kneel upon and bow his head to the floor. They are woven for the Mohammedans who say their prayers on them three times every day.

Fadi invites us to rest for a while. We sit cross-legged on cushions and she brings out a tray on which are refreshments. There are tiny cups of a sweet drink,

and plates of candy called Turkish Delight. This is a fig paste much like that we can buy at candy stores in America. Fadi's father says Persia still stands first



Algerian rug-weavers

in the making of Oriental rugs. Other countries where they are woven are Turkey, Syria, China, India, and Turkestan. For their handmade rugs, the Chinese often use yarn made from camel's hair instead of sheep's wool.



### In a Carpet Factory

The art of rug making was carried from the Orient into Europe and England and then across the ocean to us. It was in Europe that the first looms were invented which would make rugs by machinery. Oriental rugs took so long to weave and cost so much that few people could buy them. This is still true to-day. A small Oriental prayer rug may cost one hundred dollars or more, and the large ones often sell for ten times that sum. Fine old rugs have been known to bring as much as twenty-five thousand dollars.

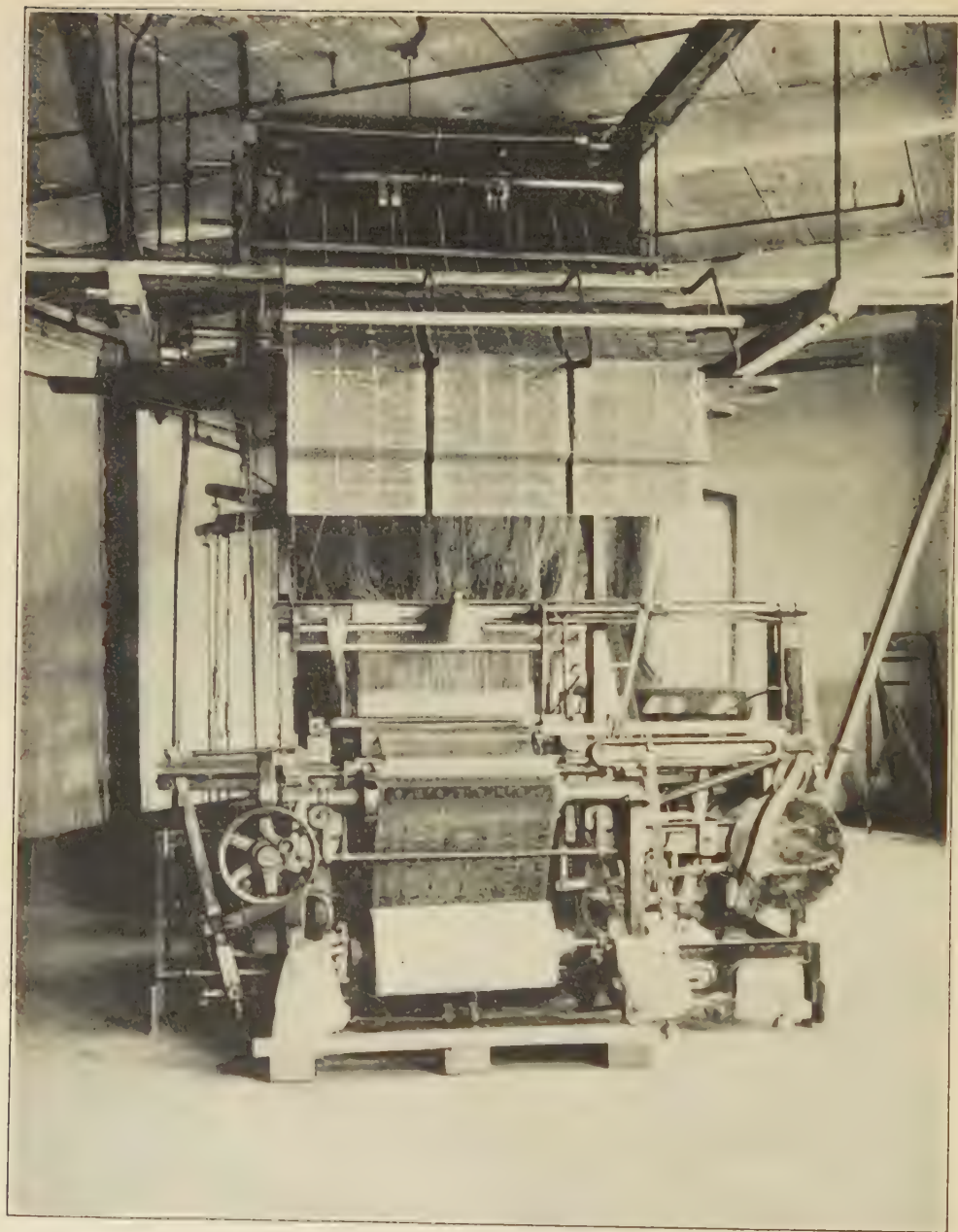
The rug-making machine was invented by a Frenchman named Jacquard. By its loom, carpets can be woven so cheaply and well that all of us may have some to cover our floors. The United States is the biggest rug maker and buyer of the whole world. Our factories weave enough every year to stretch twice around the earth-ball at its middle. We have hundreds of factories and thousands of looms working all the year round to give us our carpets.

On landing again in our own country, we decide to visit one of

these modern carpet factories of ours. We see the bales of wool unloaded from freight cars right at the door and watch them as they are opened and sorted. How fine and long the wool fibers are! We must buy our carpet wool from North Russia, Siberia, or China, for that from our own sheep is not good enough for making carpets.

In one part of the factory men are washing and picking over the wool. It must be carded or combed by whirring machines before it is spun out into fine skeins of yarn. It is carefully dyed every color of the rainbow, and the skeins are matched so as to have just the right shades. Then the wool is ready for weaving. Spools of yarn are set up in their places in the loom. The machinery is started. How quickly the work goes here! The pattern grows as we look, and in a short time we see the balls of many hued yarns turned into a strip of beautiful carpet. We find that this carpet magic is almost the same as that of our friend Fadi. But the work is done by machinery which can turn out in every hour a strip of





Machines make balls of yarn into beautiful carpets

carpet which it would take many days to tie by hand.

In the shipping room are fine Brussels carpets, Wilton rugs, which imitate Oriental designs, and cheaper Axminster carpets done in beautiful colors. Jack asks if a rug is the same as a carpet.

"No," replies the carpet maker. "A rug is usually woven all in one piece and it does not cover the whole floor like a carpet. You see, carpet is woven in strips which may be sewed together when it is laid."

Edith tells how she used to help her grandmother make carpet-rags. They cut all the odds and ends of cloth into long strips and sewed them end to end. They wound them into big balls and took them to the old carpet weaver who lived near their farm. He wove them into rugs on a

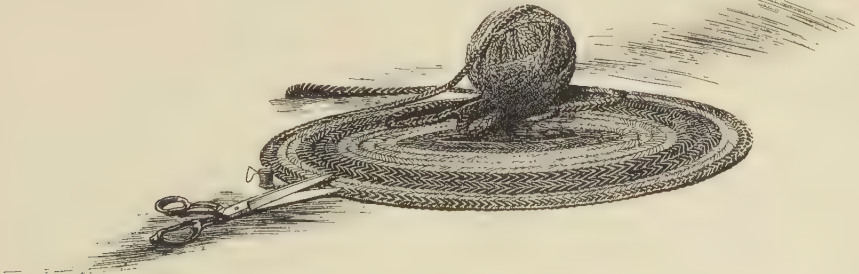
crude hand-driven loom. Sometimes he put in the colored rags to make a pretty design.



*W. & J. Sloane*

A Wilton rug made in America

The carpet maker gives us some scraps of machine-made rugs for our Museum. There is a square of straw matting from Japan, another Far Eastern mat woven from the fibers of the coconut husk, and last of all a piece of linoleum such as we use on the floors of our kitchens.



## CHAPTER 20

### JACK'S VISIT IN AN APARTMENT HOUSE

JACK is visiting his cousin Jim in a great city. Here is a letter from him which was brought by air mail. It came in less than half the time of one sent on the train. Jack's letter reads :

Dear Journey Club :

I am writing this letter high up in the air. I am sitting at a window more than one hundred feet above the front door of our building. You see, my cousin Jim lives in an apartment house. It is a huge pile of stone and brick. Jim says all the beams are of steel and the inner walls are chiefly of metal. Steel and stone do not burn like wood, so this building is said to be fireproof.

Just think ! There are sixty families living in this one house. They each rent a number of rooms adjoining each other. Every

apartment here is planned so as to have bedrooms, a dining room, a living room, and a kitchen, as well as one or more bathrooms. All the rooms are on the same floor. That is why an apartment is sometimes called a flat. It seems queer to me not to go upstairs to bed.

The electric light, the heat, and the water for all these different apartments come from the same place, sometimes in another part of the city. Each family pays for the amount it uses. One man spends his entire time taking care of the building. He is the manager. Several other men help him, and he also hires the elevator boys and the women who scrub the halls every night. Jim's mother tells the manager when anything goes wrong in her apartment, and he sends some one to fix it.





Modern cities have very tall buildings

I wish we might have a meeting of the Journey Club on the roof of this building. All through the summer it has tubs of plants and flowers upon it. It is a fine place to play ball. But Jim and I have to take care that our ball does not fly over the edge and drop to the street far, far below. To get it then we have to ring for the elevator and ride down to the first floor. I have not used a stairway since I came here.

This apartment has a fine en-

trance hall, walled with white marble like that from Mr. Barnes' old sheep pasture up in Vermont. Near the front door is a telephone switchboard and a girl operator who rings up the different apartments to give messages and calls.

Jim says there are in all our great cities apartments which even have rooms to serve as garages. The tenants can thus keep their automobiles in their own building.

Jim's mother likes living in an



apartment. She says she has less work to do than she would have in a big house. Thousands of families are housed in this way in every big city. In some places the separate apartments are sold instead of rented. The owners make the repairs in their partic-

to the business section of Chicago. The busiest part of it is called the Loop because the elevated trains make a complete loop around it. My neck often grows tired with looking up at the tall buildings there. I know now why these are called skyscrapers.



A hotel lobby

They rise so high above the sidewalks and streets that they seem really to scrape the blue sky. Sometimes their tops are almost lost in the clouds.

Jim's father has his office in just such a skyscraper. When we go to see him, we shoot up in an elevator which rises so quickly I most lose my

ular flat, and share the expense of running the building with other families who also have bought parts of the house.

Many apartment buildings are smaller than this one in which Jim lives. They are more like those we have in our town. Some hold but four families and some even fewer. The separate flats may have only two or three rooms, or again as many as ten or twelve.

I enjoy going with Jim down

breath. We step out at the twentieth floor and walk down a hall past room after room. Different names are lettered on the doors of each office. There are enough people at work under this one roof to fill a small town. These great office buildings are built of steel and stone too, for they must be fireproof.

Who would ever think of finding a church in a skyscraper? But there is one here in the busiest part of the Loop. It is called



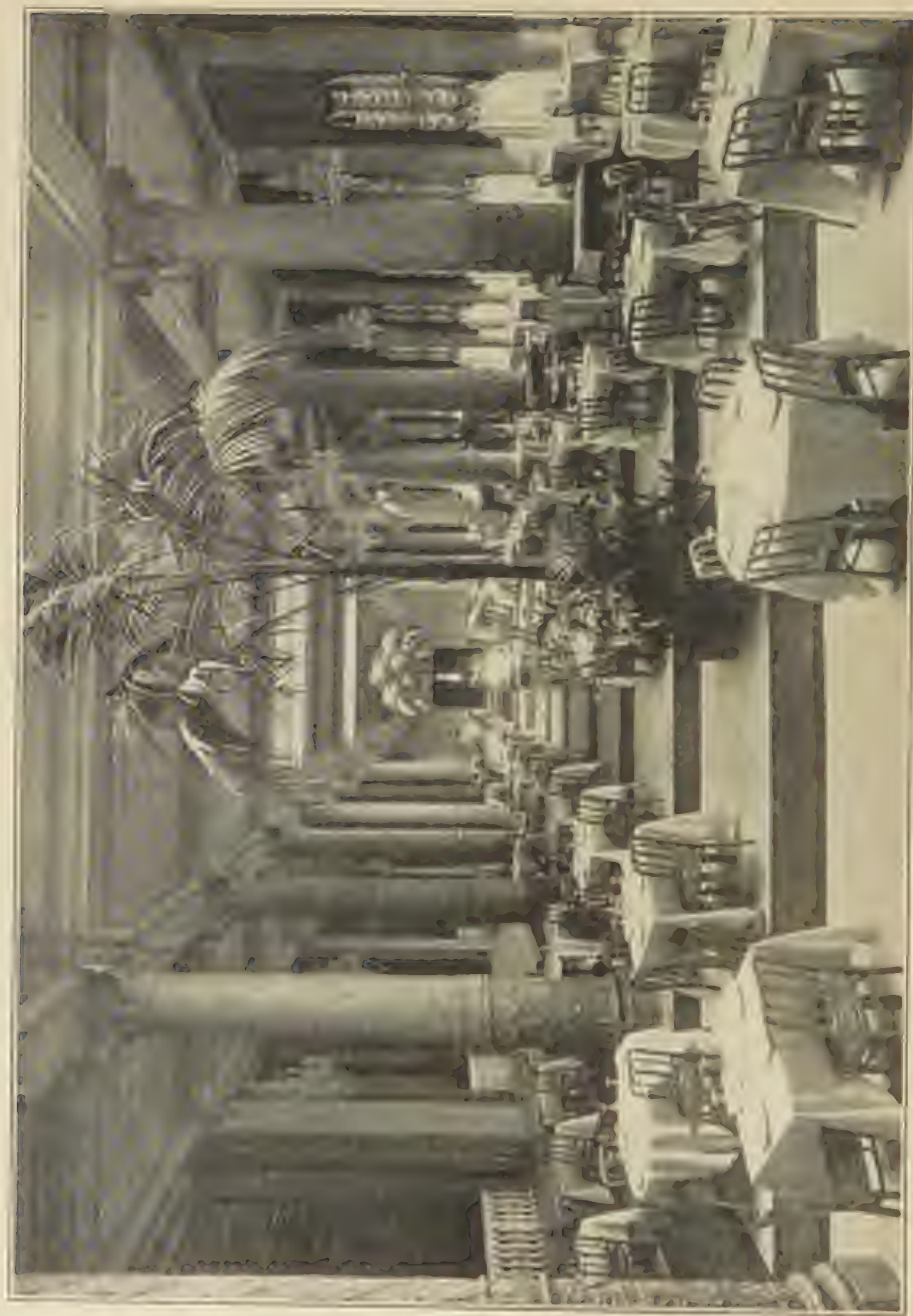
A parlor in a modern hotel

the Methodist Temple and its church rooms are on the ground floor of one of the tallest of the office buildings in Chicago. It holds services just like those of our churches at home. Above the church there rise many stories of business offices, and at the very tip-top is a beautiful steeple which ends in a cross. This cross can be seen for miles over the house tops.

To-day we had an interesting trip. We went through a hotel, the biggest one I ever saw. It has room for more than one thousand guests, and it takes one thousand servants and helpers

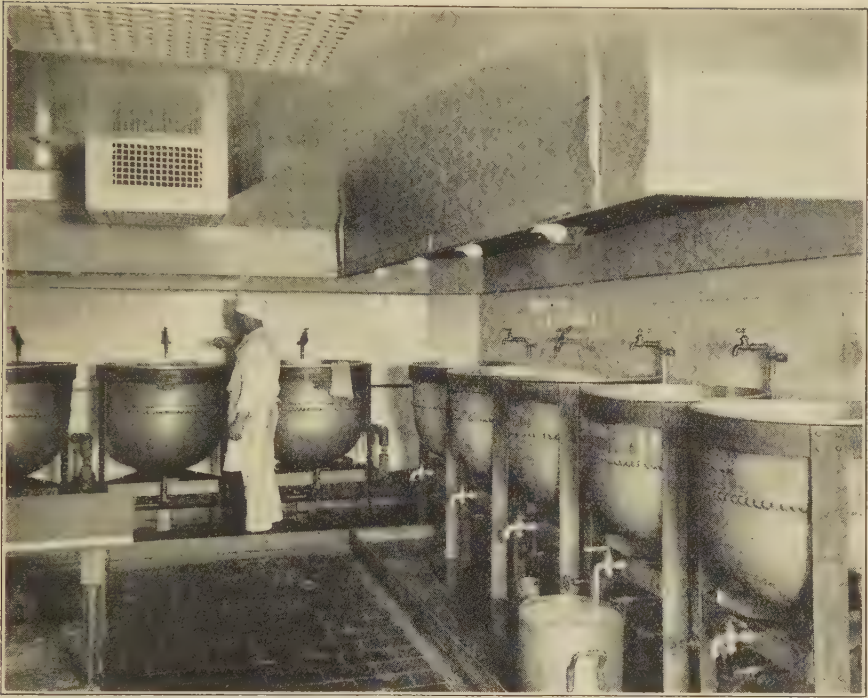
to do the work of the hotel. All of you remember the fine hotels in New York where we have staid during our travels with the Journey Club. Do you recall how we went up to the office in the entrance hall or lobby? We each wrote our name and the town where we live on a leaf in the guest book. The clerk gave us our keys and the bell boys grabbed our bags and led the way to our rooms.

I like the beautiful parlors of big hotels and the dining rooms with their flowers and snow white cloths on their tables. But



A hotel dining room





We saw tubs of soup as big as barrels

you should see the wonderful kitchens. We went down underground and walked through room after room where hundreds of men and women were working away, preparing the food for the people dining in the gay rooms upstairs. We saw an army of cooks in white aprons and caps. Some were roasting the meats, some making the soups, and others were fixing the vegetables. Special cooks are skilled in molding desserts, and bakers dressed

in white bake all the bread. I saw gallons of soup in tubs as big as barrels, and one oven as long as our schoolroom at home. All the dishes and silver are washed and dried by machines.

The hotel I saw to-day is quite different from those at home. And yet most hotels are run in about the same way. My visit is almost over. I shall be at our next meeting.

Your friend,  
Jack.



## CHAPTER 21

### THE JOURNEY CLUB BUILDS A HOUSE

THERE is great excitement in the Journey Club to-day. Our long travels are over for the present. We have journeyed hither and yon, at home and abroad, to find out about wood, stone, metals and glass, paper and paint, and other materials used in building our homes. We are now ready to see how all these things are gathered together and put into their places.

So we are going to build a house for ourselves. Although it is to be only a playhouse, we shall do everything just as if we were grown-up builders and as if the house were big enough to hold one of our own families. Our parents have promised to help buy our materials and give us advice.

First of all we must have land on which to build. Jack's father owns a fine vacant lot. He offers

to sell us a corner of this for a small sum. We go with him to the City Hall and seek out the man who keeps records of all the owners of land in the town. Jack's father gets from him a paper which shows that he has the right to sell this land. It gives the names of all the people who have owned it in the past and states that Jack's father bought it from its rightful owner. This right to a certain piece of land is called a title.

When we pay for our lot, Jack's father signs over his title to the Journey Club. The sale is recorded here in the City Hall so that in the future no one may claim our piece of land.

Jack's father explains that the Journey Club will have to pay each year a certain amount of money to the town government,

for taxes. Every one who owns land is taxed in this way. Taxes help build the streets, schools, and sewers, the water plants, and the fire stations.

fore and so do not know just how to start. In every town there are men who make their living by planning houses for other people. They are architects. Bob's

**THIS DEED**

Made this \_\_\_\_\_ day of \_\_\_\_\_ in the year one thousand  
nine hundred and \_\_\_\_\_, by and between \_\_\_\_\_

\_\_\_\_\_ part \_\_\_\_\_ of the first part, and

\_\_\_\_\_ part \_\_\_\_\_ of the second part:

**WITNESSETH**, That in consideration of \_\_\_\_\_ Dollars,  
the part \_\_\_\_\_ of the first part do hereby grant unto the part \_\_\_\_\_ of the second part, in fee  
simple, \_\_\_\_\_ all \_\_\_\_\_ piece \_\_\_\_\_ or parcel \_\_\_\_\_ of  
land, together with the improvements, rights, privileges, and appurtenances to the same belong-  
ing, situate in the District of Columbia, described as follows, to wit:

**AND** the said part \_\_\_\_\_ of the first part covenant that \_\_\_\_\_ will warrant  
specially the property hereby conveyed; and that \_\_\_\_\_ will execute such further  
assurances of said land as may be requisite.

**WITNESS** \_\_\_\_\_ hand \_\_\_\_\_ and seal \_\_\_\_\_ the day and year hereinbefore written.

In presence of \_\_\_\_\_

SEAL

SEAL

A blank deed

**DEED**

\_\_\_\_\_ JOHN DOE

TO

\_\_\_\_\_ THE JOHNSON CHILD

\_\_\_\_\_

RECEIVED FOR RECORD on the \_\_\_\_\_ day of \_\_\_\_\_ A. D. 19\_\_\_\_  
at \_\_\_\_\_ D. C. and recorded in  
Book No. \_\_\_\_\_ at folio \_\_\_\_\_ of the Land Records for the District of Columbia, and countersigned  
by \_\_\_\_\_

THE WASHINGTON LOAN AND TRUST CO.  
REAL ESTATE DEPARTMENT  
WASHINGTON, D. C.

The folded deed

### Plans for Our House

Now that we have our land, we must think of our house. In building, one must take care to choose a good simple style of which he shall not grow tired. We decide on a small white frame house with a green shingle roof. We think we should like to have two rooms downstairs with a hall in between, and also two rooms and bath on the story above. We have never built a house be-

father belongs to this group of men, so we go to him for advice.

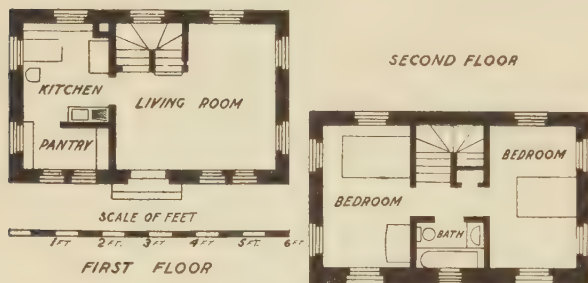
He asks us just what kind of house we want. In a few days he has drawn up the plans for us. On one sheet of paper is a sketch of the outside of our white frame house with its green shingles. On others are outline drawings of each of the two stories. These are called floor plans. They show how the rooms will be placed and where we shall

put the windows and doors. The stairway also is marked. A full set of directions tells what materials are needed and how they are to be used. Of course the plans are many times smaller than the real house will be. But they are drawn in such a way that

promises to have the house finished by a set date. Often the contractor is directed by the architect.

### The Journey Club as Builders

We decide to do all the work on the house that we possibly can all



Plans for our house

we need but to multiply to get the right measures. Our architect says they are "drawn to a scale." We like the plans so much we do not wish any changes.

Architects usually ask a certain sum for such plans. If paid in addition they will take charge of the building itself, hiring the men and watching their work. Sometimes the building work is put in the hands of a man called a contractor. He contracts to build the house for a fixed sum of money. He buys all the materials, hires all the laborers, and

by ourselves. We elect Dick as contractor, or "boss," but say he must work under the direction of Bob's father who is our architect. The rest of the Journey Club are divided among the different building trades. Each class of house-builders

does only one kind of work. So we shall act as masons, and carpenters, plasterers, and paperers, as well as painters and plumbers.

The first task before us is to lay the foundation. It is hard work to dig a hole big enough for the cellar under the house. It takes several days, and the boys do most of the digging. They enjoy the masonry work better. They like to lay the bricks one on the other and set them in a mortar to hold them tight in their places.

Bob's father tells us that the

foundation is one of the most important parts of a house. If it is not strong and firm, the house may lean to one side like the famous leaning Tower of Pisa in Italy. The foundation must be solid enough to bear the weight of the whole building. For a skyscraper of thirty stories or more, long posts are driven down into the ground before the foundation is laid. In some places steel rails are placed on the earth and filled in with concrete. A house built upon them really sets upon rock. In our everyday houses the foundations are usually of wood, brick, or stone carefully laid.

When our foundation is ready we begin our carpenter work. Dick calls the Journey Club carpenters to bring the saws and the hammers, the nails and the bolts. They first set up a framework of timbers and beams. Then they nail into place the smooth outside boards. So the walls are built up. The sloping rafters are now covered with shingles which may have come from the forest we visited in the Northwest.

We have ordered our windows and doors from a factory which

makes such woodwork only. Following our plans, we have been careful to leave the right places for them. As we look at the thin boards which form the walls of our playhouse, we think of the thick stonework in the huge office buildings down town. Jack says Jim told him that in fireproof skyscrapers, the walls are often steel plates covered with thin brick overcoats. Our own houses have walls of many different materials. They may be of wood, stone, brick, or concrete. It all depends on the kind of a house we have.

Let us count on our fingers the kinds of roofs we have seen. "Shingles," cries Edith, "Boards," says Helen. And, "Tin," "Iron," and, "Slate," call out Jack, Dick, and Bob. Mary likes best shiny roofs of glazed tile in the brightest of colors. There are also roofs of asbestos shingles and some of copper and other metals. As we talk about roofs, she repeats a nonsense verse by Oliver Herford. It runs —

"The Roof, he has a lazy time,  
A-lying in the sun.

The walls, they have to hold him up  
They do not have much fun."





The Journey Club playhouse is nearly finished

Our playhouse is too small to permit us to stand up inside it to work. So we must take off some of the back wall-boards. We put in the floors and ceilings and the inner walls. We build tiny steps and we plaster and paper and paint the inside wood-work white.

Now comes the plumbing and lighting. Mary's Uncle Fred is a plumber by trade. He gets some tiny lead pipes for us and shows us how to install them. We pay an electrician to wire our house for us. This must be done with the greatest of care. The wire must be well covered and properly placed lest the electric current should set fire to the house. When all this is done, we put back the wall-boards, and our house is ready for painting.

The walls are given several coats of white and we stain the shingles a dark green. We use

paint of the same green shade for the trimmings and the frames of the windows and doors.

At last our playhouse is finished. It has taken us several weeks to put into their places all the materials called for in the plans. We now know how much work and how many men are needed to give us our comfortable homes. We recall the workmen we saw in the forests and lumber mills, in the quarries and mines, in the brickyards and glass works, and in the pulp and paper mills. We must now add to these the masons and carpenters, the tinnerns and roofers, the paperers and plasterers, and the plumbers and electricians. We must not forget the people who prepare our gas, oil, and electricity, nor the men and the women in our furniture factories. To all these and many more do we owe the houses we live in.



## SUGGESTIONS TO TEACHERS

*The following suggestions to teachers are divided for convenience into two groups: first, the general suggestions applicable to all parts of the book; and second, the special suggestions which apply to particular chapters.*

### GENERAL SUGGESTIONS

**The Journey Club.** — It is important that a real club be formed, with officers elected by the children. These may be changed every few chapters. Records should be kept of the places visited. Projects relating to subjects other than industrial science — such as reading, silent or aloud, composition, nature study, etc. — may be introduced by the teacher.

**The Journey Club Museum.** — The value of the Museum cannot be overestimated. A set of shelves provides the place for the exhibits. The actual work of labeling and arranging the exhibits should be done by the children, but suggestions as to materials for this purpose will be found both in the text and in the special suggestions that follow.

**Maps and Pictures.** — There should

be a large map of the world on which to trace the routes of the Journey Club travels. Small pins or flags add clarity in locating stops. Photographs should be obtained wherever possible. The children should draw pictures of the articles studied.

**Blackboard, Clay, and Sand Table.** — The blackboard may be used for drawings. Clay will be useful for reproducing houses and house materials. The sand table may serve to show whole scenes; such as, a home in the desert, an open-pit iron mine, a quarry, etc.

**Excursions.** — Wherever possible, the children should take short trips to study raw materials. These trips should be followed by visits to neighborhood factories to see how the raw materials are made ready for use.

### SPECIAL SUGGESTIONS FOR PROJECT PROBLEMS

**Chapter 1.** — The Journey Club should meet to elect officers. Shelves should be provided for the housing exhibits.

**Chapter 2.** — The children should

mold in clay or demonstrate on the sand table the kinds of houses treated in this chapter. Tents may be fashioned of cotton cloth, and sand may represent the

desert. Huts may be molded in clay and thatched with bits of straw or hay. For the Museum: the articles made by the children; pictures of tents, huts, grass houses, and oriental homes.

**Chapter 3.** — This chapter should be acted by two of the children, in costume if possible. Both log cabins described should be made in class. Twigs may be used to represent logs and thin wooden boxes may be split into slabs for the roof and the doors. Oiled tracing paper may be used for windows, and the doors should be hung on leather hinges. Or the whole may be modeled in clay. These will furnish the exhibits for the Museum for this chapter.

**Chapter 4.** — For the Museum: card-boards on which are pasted pictures of various things made of wood. Magazine advertisements will give many of these. Also pictures of the different kinds of trees. Nature study projects may be introduced in this connection.

**Chapter 5.** — The children should build a raft of logs. Twigs or tooth picks may serve as material. A visit should be made to the nearest lumber yard. For the Museum: odds and ends of lumber; samples of woods showing different grains.

**Chapter 6.** — A quarry should be molded on the sand table. Clay could be used to show the rocky formation of the pit. For the Museum: scraps of granite, marble, limestone, sandstone, slate; pictures of the Pyramids, etc.

**Chapter 7.** — Small blocks of concrete may be made in the schoolroom. A few small pebbles, a little sand, and

some Portland cement may be mixed with water and molded in a square tin box. The letters J. C. should be stamped in one side. For the Museum: the blocks so made; also bits of stucco, plaster, and mortar.

**Chapter 8.** — Bricklaying may be illustrated with a few bricks. Mortar may be secured from a house builder, and the bricks laid one on the other with the mortar between. This should show the actual hardening of the mortar. For the Museum: a house-brick; bits of tile, clay pottery, and terra cotta.

**Chapter 9.** — A magnet's attraction for iron and steel should be demonstrated. The making of pig iron may be shown on the sand table. Straight rows of trenches should be dug, and plaster of paris run into them in place of the molten iron. For the Museum: a piece of iron ore; samples of cast iron, wrought iron, and steel.

**Chapter 10.** — A visit should be made to the largest hardware store in the neighborhood. For the Museum: nails, screws, hinges, locks, and other bits of hardware.

**Chapter 11.** — The children should bring some article made from the metals studied. They should arrange them as suggested in the text.

**Chapter 12.** — Window panes in their various stages should be molded in clay. First the lump of glass mixture, then the pear-shaped bubble on the end of the pipe, next the long cylinder, and lastly, the flat sheet. A small piece of cut glass should be borrowed for this lesson. For the Museum: window glass,



plate glass, and some article of molded glass; pieces of colored glass, a glass bottle, and other objects mentioned.

**Chapter 13.** — The children should print a design on white paper. Use a small block of wood on which has been carved a flower or bird. Often cheap rubber stamps may be secured at a toy store which will serve to illustrate the theory of printing. For the Museum: small pieces of wood, and a bunch of cotton or linen rags, to represent the raw materials from which paper comes; plain white paper, and scraps of wall papers.

**Chapter 14.** — This chapter should be enacted. The experiment made by Bob on page 128 should be performed in the schoolroom. For the Museum: a tiny can of paint; a brush; a card of sample colors; a bit of white lead; bottles of linseed oil, turpentine, and varnish.

**Chapter 15.** — An old-fashioned well should be molded on the sand table. A windmill may be made by the children from wood and paper. For the Museum: these articles; a piece of lead pipe; and a spigot.

**Chapter 16.** — The children should make miniature candles, using a few ordinary candles melted to a liquid over an alcohol lamp. The wicks may be braided thread two or three inches long. The scene of the candle dipping in the text will serve as a guide. Fire should be made without matches. For the Museum: a tallow candle; a Betty-

lamp molded in clay; spills of twisted paper; bottles of kerosene, gasoline, and crude petroleum; and an electric light bulb. Lighting and cooking by gas should be represented by pictures.

**Chapter 17.** — The heat in the rays of the sun should be demonstrated by holding a magnifying glass in the sunlight so that the converged light rays center on the back of a child's hand. A trip to see the heating plant of the school will be of practical value. For the Museum: samples of hard and soft coal of various sizes; also bits of lignite and peat where these can be obtained.

**Chapter 18.** — An interior decorating magazine may be used with this chapter. For the Museum: pictures of a grandfather's clock, four-posted bed, and modern furniture.

**Chapter 19.** — Rug weaving may be illustrated on a wooden frame. Colored knitting yarns may be tied in place and pushed down with an ordinary coarse comb. For the Museum: scraps of yarn; pictures of Oriental rugs; small bits of domestic carpet.

**Chapter 20.** — For the Museum: pictures of office buildings, of apartment houses, and of great hotels.

**Chapter 21.** — If it is not practicable to allow the children to build a small playhouse in the school yard, the building process should be made into a play and acted out in detail as suggested in the text. Trips should be taken to see houses in construction.

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